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Electrical World

January 19, 1946

42nd Annual

STATISTICAL

Issue

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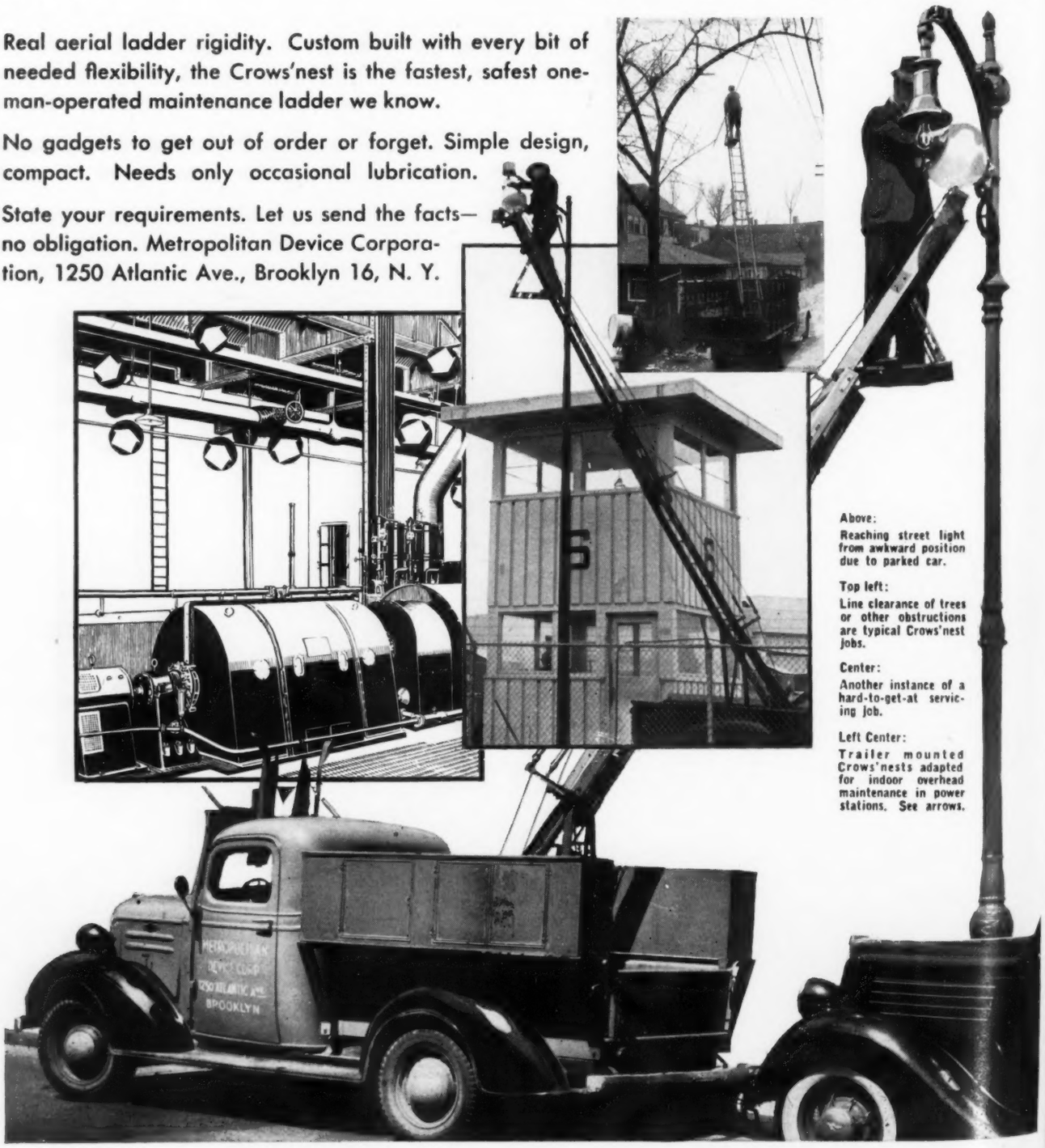

Above:
Reaching street light from awkward position due to parked car.

Top left:
Line clearance of trees or other obstructions are typical Crows'nest jobs.

Center:
Another instance of a hard-to-get-at servicing job.

Left Center:
Trailer mounted Crows'nests adapted for indoor overhead maintenance in power stations. See arrows.

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 72 YEARS

January 19, 1946 — Vol. 125, No. 3

Contents

42nd ANNUAL STATISTICAL NUMBER

Highlights 108
Trend 109
Output 110
Capacity 112
Customers 115
Energy Sales 116
Revenue 118
Expenses 120
Budget 122
New Capacity 124
Transmission and Substations 127
Rural Lines 128
Maintenance 129
Station Economics 130
Government Power 132
Financial 134
Outstanding Facts 135
Manufacturing 136
REA Operations 138
Chronology 139

The Year in Review 140
FRANK R. INNES, Associate Editor, "Electrical World"

Electrical Manufacturers Plan Market Expansion 142
R. L. WHITE, President, National Electrical Manufacturers Association

Editorials ..... 107 and 144
Washington Comment 146
News of the Week 147
HOW 155
Engineering Reference Sheets ..... 166, 168 and 170
Load Building 184
New Equipment 192
News About People 203
Manufacturing and Markets 220
Sales Opportunities 232
Recent Rate Changes 234
Rural Allotments and Contracts 236
Book Reviews 239
Index of Advertisements 246

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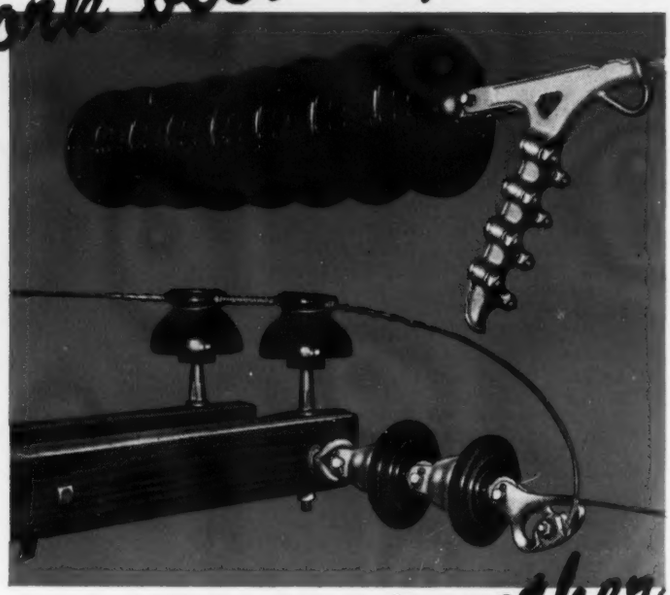

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THE RECORD OF A DECADE IN THE ELECTRIC UT

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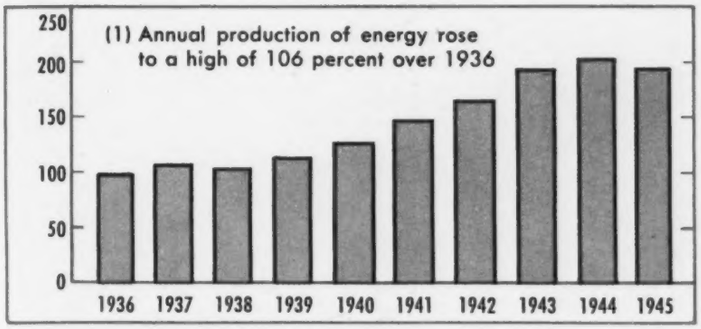
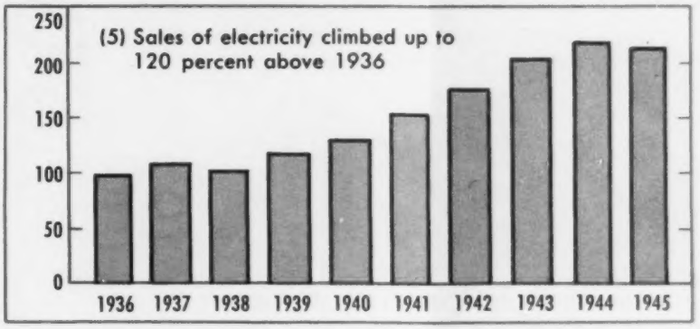
Based on E.E.I. and F.P.C. Data

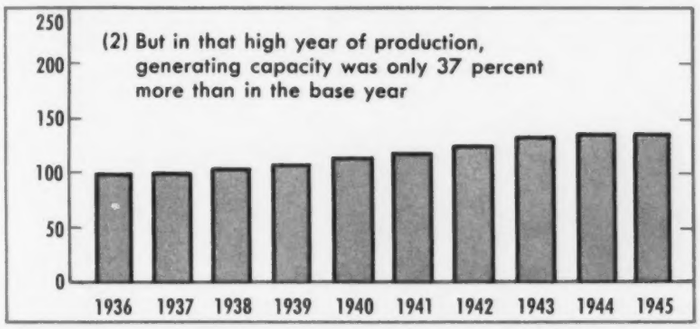
In the ten years for which weekly outputs of electricity are shown in the large cha



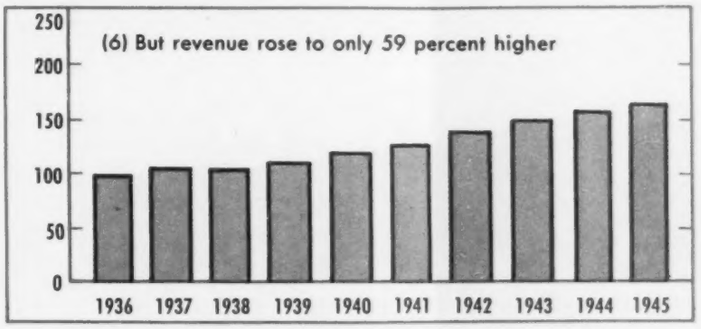
Output—112,181,000,000 kw.-hr. in 1936=100



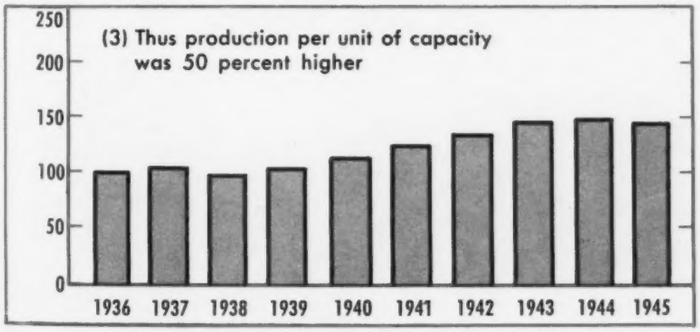
Energy Sales—90,044,265,000 in 1936=100


(2) But in that high year of production, generating capacity was only 37 percent more than in the base year
250
200
150
100
50
0
1936 1937 1938 1939 1940 1941 1942 1943 1944 1945

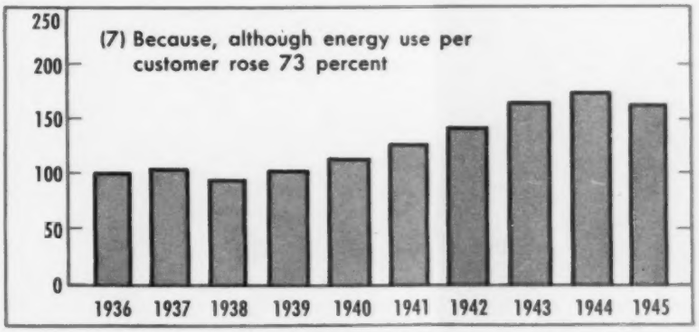
Capacity—36,564,000 kw. in 1936=100



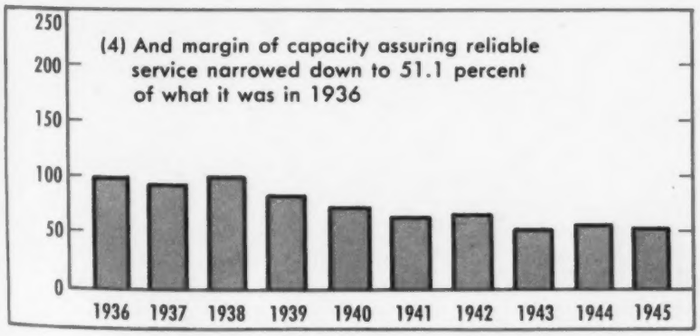
Revenue—$2,044,586,900 in 1936=100



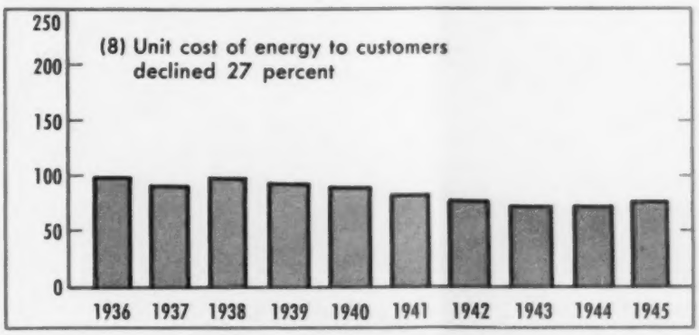
Production—3089 kw.-hr. per kw. in 1936=100



Sales per Customer—3504 kw.-hr. in 1936=100


(4) And margin of capacity assuring reliable service narrowed down to 51.1 percent of what it was in 1936
250
200
150
100
50
0
1936 1937 1938 1939 1940 1941 1942 1943 1944 1945

Margin—32.7 percent in 1936=100

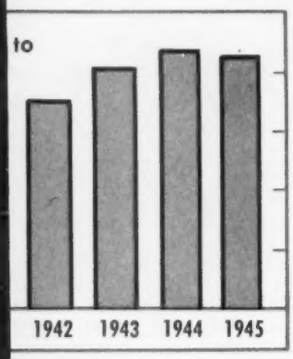


Revenue per kw.-hr.—2.27¢ in 1936=100

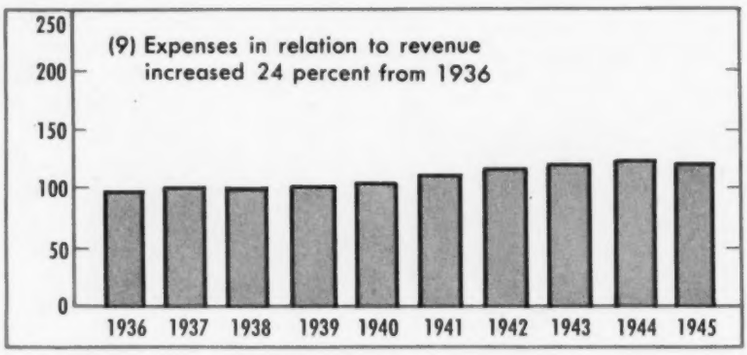
ELECTRIC UTILITY BUSINESS

Supplement to ELECTRICAL WORLD, January 19, 1946

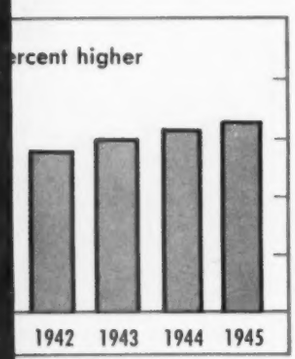
are shown in the large chart at the right



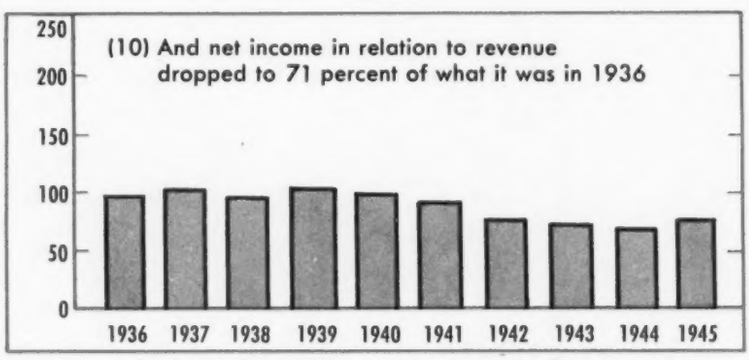
000 in 1936 = 100



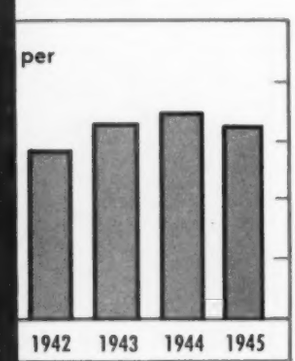
Operating Ratio after Taxes — 52.5 percent in 1936 = 100



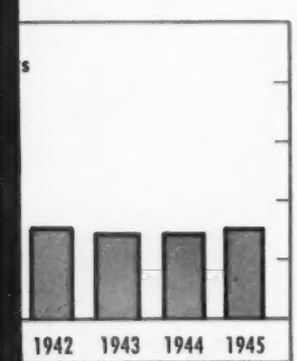
in 1936 = 100



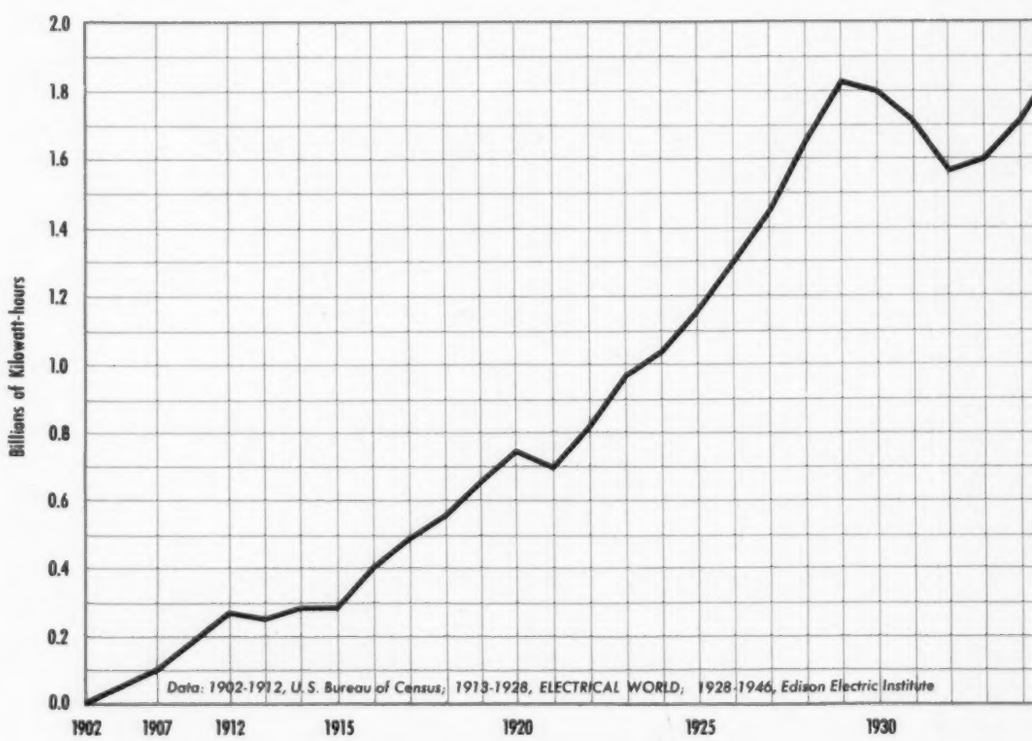
Net Income Ratio — 20.1 percent in 1936 = 100

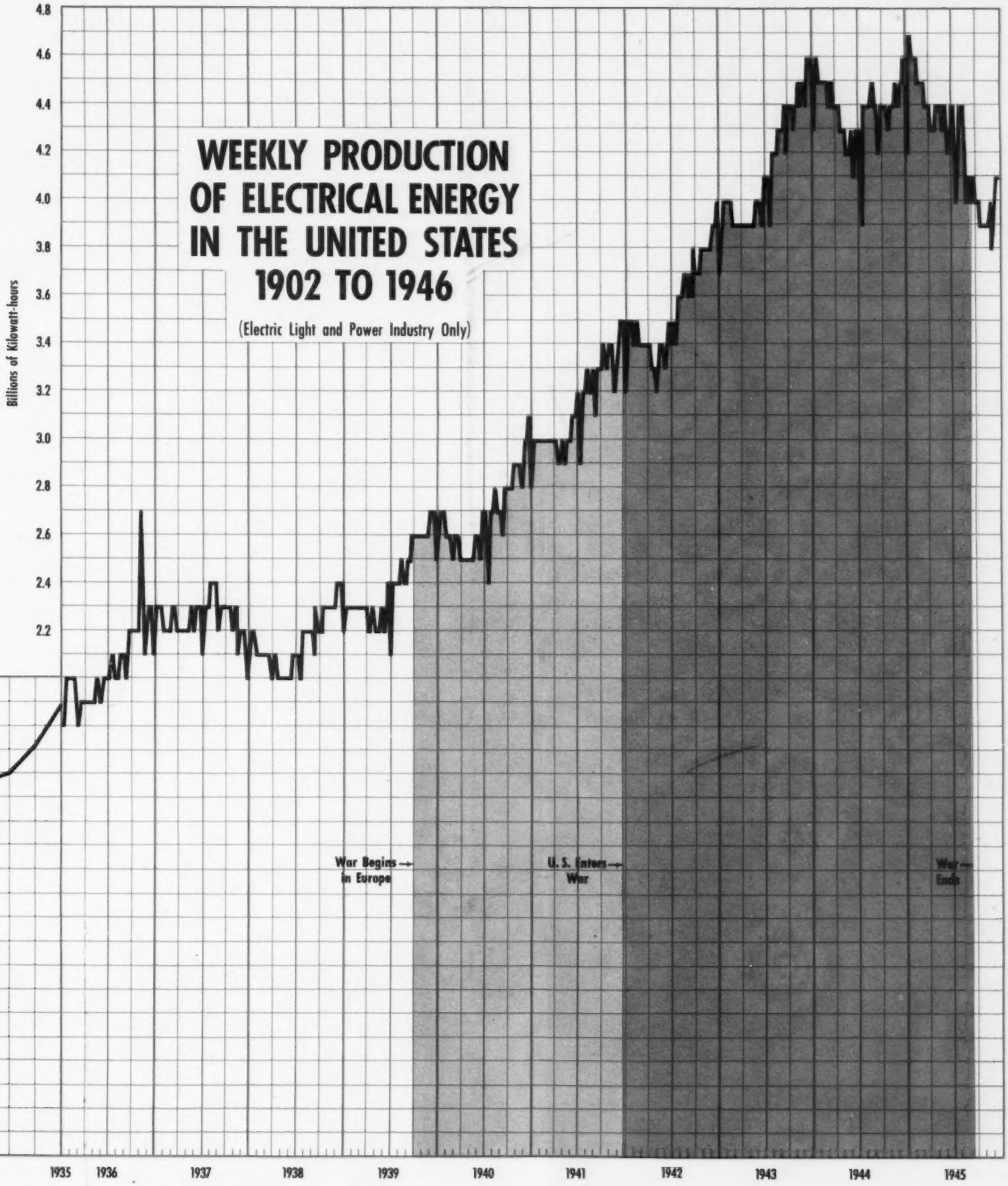


w.-hr. in 1936 = 100



7¢ in 1936 = 100




WEEKLY PRODUCTION
OF ELECTRICAL ENERGY
IN THE UNITED STATES
1902 TO 1946
(Electric Light and Power Industry Only)
Billions of Kilowatt-hours
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
War Begins in Europe
U. S. Enters War
War Ends
1935
1936
1937
1938
1939
1940
1941
1942
1943
1944
1945

A NEW CHAPTER

The page has been turned. In the history of the electric utility business a chapter has ended; a new one is beginning.

The performance of the utilities during the war is now a record of the past. That the record is good, that it contains no entry noting failure, is a just reason for pride. But it is not a good reason for complacency in facing the days ahead.

For the men and women of the industry there is more than a glow of satisfaction to be taken from their war record. There are lessons of more economical operations, of more efficient utilization of facilities, of better performance all along the line.

The pride and the satisfaction can be laid aside, but the lessons must be carried over into the new chapter that is beginning.

To accomplish its appointed task of keeping this nation in secure position as leader of the world in production and use of electricity, the power industry must expand and grow as never before. The spirit of enterprise must pervade more widely, inform more actively, the minds of the leaders of the industry than has been the condition in the fifteen years before and during the war.

The trends that are indicated both implicitly and explicitly by the statistics in this number of "Electrical World" are not those of an industry of large profit potentialities. But they are the trends of an industry solidly established, with a record of service unsurpassed by any other, and capable of reasonable earnings, given that the free-enterprise economy of this nation survives without crippling change the inevitable social and political readjustments of the post-war period.

The situation appears to be, as the new chapter in their history opens, that the electric utilities can grow and can earn in the post-war world if they will apply the lessons of the past and will appreciate and develop the opportunities of the future.

One conspicuous opportunity is in residential service. The phenomenally large increase in use of electricity by residential customers during the war years is convincing evidence of how that market can be made to grow by intelligent cultivation now that appliances are becoming available.

Another opportunity is in lighting, commercial and industrial at first, but home lighting crowding close behind. Highways and streets, more and more enforcing their demands with arguments of death and injury, assert their need of the safety offered by good lighting. Production techniques, with years of development telescoped into months in the urgency of war time, wait on promotion and selling effort to increase the uses of electricity in industry.

It will take vision to see and enterprise to work out these and the many other opportunities for extended electric service. In them are the hope of future earnings for the industry, earnings that will be realized in the degree that the lessons of economy and efficiency learned during the war years are applied to post-war operations.

Courage, enterprise, and vision can make this new chapter better reading than any that have preceded it in the history of the electric utilities.

effects following end of war

HIGHLIGHTS

OUTPUT: 222 Billion Kw.-Hr.

Drop of 3.6 percent from 1944 is first decrease in output since 1938. Good water year causes 8 percent increase in hydro generation. Government plants generate 18.8 percent of total.

CAPACITY: 50 Million Kw.

Net addition to capacity in 1945 smallest since 1941. Present ratios of fuel and hydro capacities are 30 and 70 percent. Government plants, federal and local, make up 19.5 percent of capacity employed in public supply.

NEW CAPACITY: 1.5 Million Kw.

Additions to capacity in 1946 are preponderantly in fuel power, less than 3 percent in hydro. Additions in prospect for 1946 and later total over 5.6 million kw. Of this total about 25 percent is in government plants.

CUSTOMERS: 34 Million

Rate of growth in number of customers four times as fast in 1945 as in 1944. Large increase in small light and power class indicates many new commercial and small industrial businesses being started. Fastest increase in customers is in the South.

ENERGY SALES: 194 Billion Kw.-Hr.

Down from 1944, but by less than 2 percent. Decrease of 5 percent in sales to large industrial customers, largely recovered by increases to residential and other customers. Residential average rises to 1,225 kw.-hr. per year.

REVENUE: 3.3 Billion Dollars

Up about 2 percent over 1944, despite slight decrease in total sales. Residential customers pay average annual bill of $41.90 at average rate of 3.42 cents. Increment rate of 2 cents for additional kw.-hr. used by residential customers in 1945.

EXPENSES: 2.5 Billion Dollars

After operating expenditures, taxes and depreciation are taken out of revenue, about $800,000,000 left for fixed charges and dividends and surplus. Operating ratio continues to rise, now 41.3 percent before taxes and 64.2 after.

BUDGET: 895 Million Dollars

Construction expenditures estimated for 1946 more than double 1945 and are exceeded only once in history of the industry. Distribution takes 40 percent of total, production plant next with 35 percent, followed by 20 percent for transmission.

FINANCING: 1.4 Billion Dollars

Refunding in 1945 heaviest known in the industry. New money increasing, but still only very small part of total financing. Bond and preferred stock yields decrease. Eight common stock issues in 1945 as against one in 1944.

MANUFACTURING:

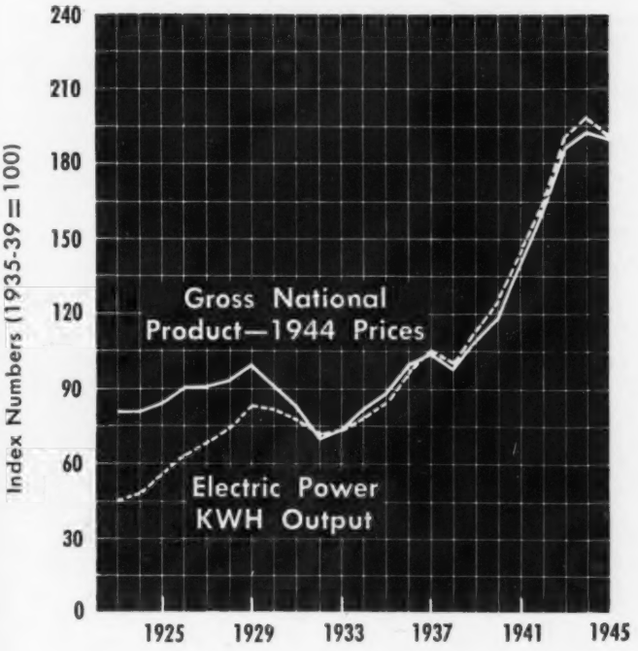
Production indexes decline in 1945 as conversion to civilian goods is delayed. Starting of appliance production is indicated, but hardly more than that.

REA: Over 2 Billion Kw.-Hr. in Sales

Average customer used 1,525 kw.-hr. in 1945, paid $52.60 at 3.45 cents per kw.-hr. Systems with generating plants rise from 65 to 74 and total capacity from 76,500 to 94,600 kw.

gross national product and electricity output

TREND



In any consideration of economic prospects for 1946, it is instructive to study the record of past years. Gross national product—the nation's total output of goods and services—expressed in 1944 prices is plotted by years from 1923 to date on the chart on this page (solid line).

The outstanding fact in the record is the strong upward trend of the nation's economic activity. Between 1910 (not on chart) and 1929, national output doubled. Even after the severe dislocation in the early 1930's, gross national product pushed into new high ground in 1936 and reached a level almost 20 percent above 1929 in the last pre-war year.

The point is that the economy moved on to new high levels after each depression and after the first World War.

The historical record, then, indicates that post-war economic activity will be substantially above pre-war experience.

For the past 14 years, there has been an extremely close relationship between electric power output and the gross national product. For instance, electric power kw.-hr. output rose 61 percent between 1940 and 1944 while gross national product rose 64 percent; and a drop of 5½ percent in total economic activity in the 1938 recession was accompanied by a 4 percent decline in electric power output.

Gross National Product (102.3=100 percent)* Billions of Dollars			Electric Power Kw.-hrs. Output (115,900,000=100 per cent)* Thousands of Kw-hrs.		
Year		%	Year		%
1925	86.4	84.4	1925	65,751,137	56.7
1926	92.3	90.2	1926	73,688,669	63.5
1927	93.1	91.0	1927	79,364,895	68.4
1928	96.0	93.8	1928	86,557,804	74.6
1929	101.8	99.5	1929	95,925,226	82.9
1930	93.4	91.2	1930	94,651,597	81.6
1931	84.1	82.6	1931	90,728,821	78.4
1932	71.9	70.2	1932	82,376,772	71.2
1933	75.1	73.4	1933	84,736,229	72.3
1934	83.7	81.5	1934	90,805,524	78.3
1935	90.1	87.9	1935	98,464,073	84.9
1936	102.9	100.5	1936	112,181,242	96.7
1937	106.3	103.9	1937	121,836,813	105.1
1938	100.5	98.2	1938	116,681,423	100.6
1939	111.6	109.0	1939	130,336,050	112.3
1940	121.1	118.2	1940	144,984,565	124.9
1941	143.3	140.0	1941	168,169,980	145.3
1942	164.5	161.2	1942	189,181,159	163.2
1943	190.9	186.4	1943	220,969,521	191.3
1944	198.7	193.0	1944	230,649,000	199.0
1945	195.0	190.0	1945	222,367,076	192.0

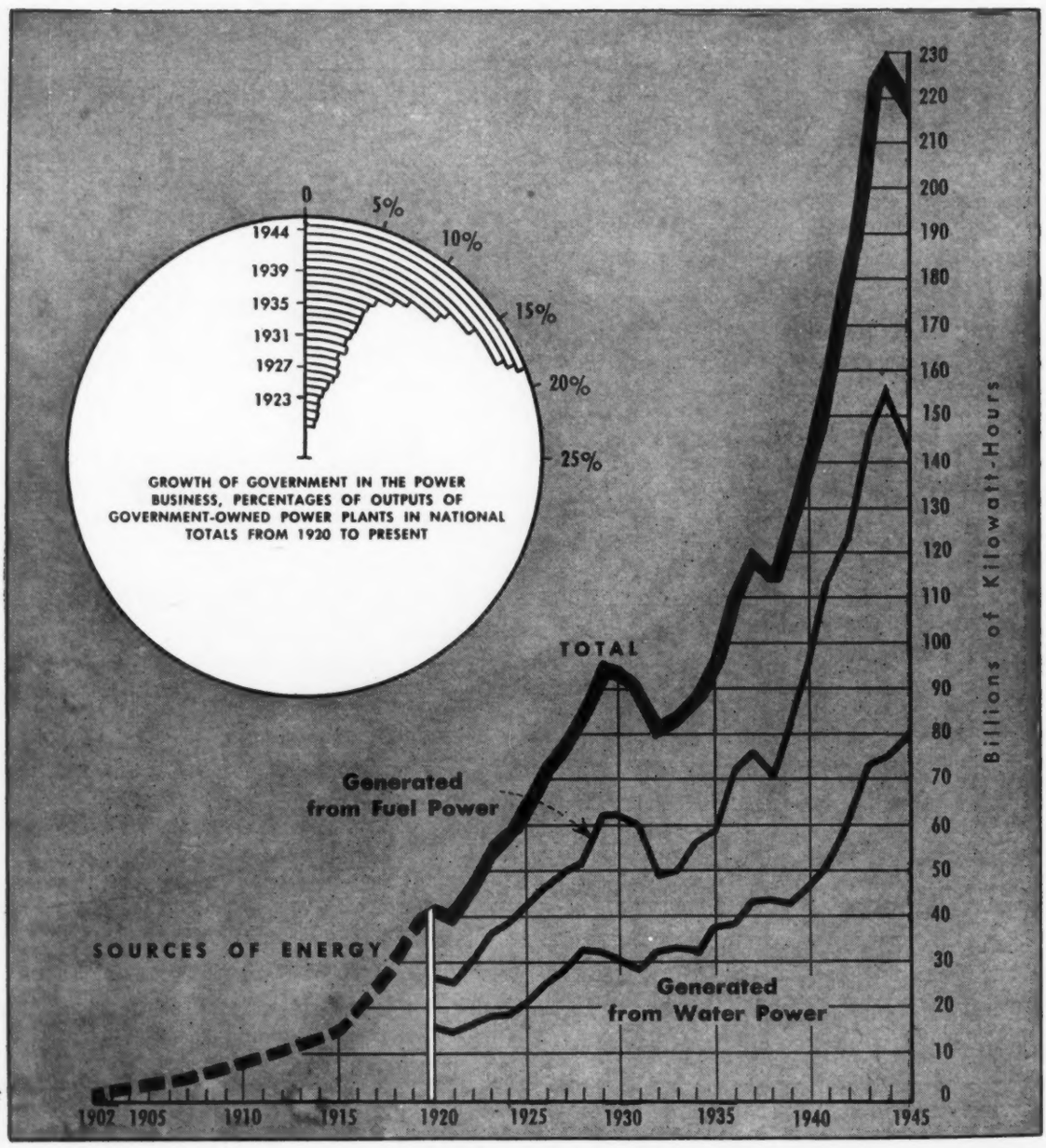
* Index numbers: Averages of 5-year period, 1935-1939 = 100.

This close relationship suggests that 1946 electric power output will decline by about the same margin as total economic activity is expected to; namely, 18-20 percent.

This does not mean that electric power revenues are in for a decline of this magnitude. The drop in kw.-hr. output will be attributable to the decline in industrial activity from war levels. Residential and rural sales, on the other hand, should increase as more new houses are built, as output of electrical appliances accelerates and as lines are extended to new customers. While this will not offset the drop in kw.-hr. industrial sales, it may wipe out a large share or all of the decline in revenues from those sales or even, as was the case in 1945, carry revenues to higher levels.

222,367,000,000 kw.-hr.

OUTPUT



Source and Disposal of Energy

(In Millions of Kw.-Hr.)

Year	Generated from		Total Generation	Add Imports from Canada	Less Energy Used by Producer	Total for Distribution	Losses	Sales to Ultimate Consumers
	Fuel Power	Water Power						
1931	61,119	29,580	90,729	794	5,459	86,064	14,162	71,902
1932	49,055	33,322	82,377	446	5,248	77,575	13,864	63,711
1933	50,678	34,058	84,736	613	4,910	80,439	14,523	65,916
1934	57,093	33,713	90,806	893	5,499	86,200	15,118	71,082
1935	59,430	39,034	98,464	901	5,669	93,696	16,100	77,596
1936	72,665	39,516	112,181	1,054	5,826	107,409	17,365	90,044
1937	77,348	44,489	121,837	1,733	6,428	117,142	17,783	99,359
1938	71,847	44,834	116,681	1,867	6,990	111,558	17,826	93,731
1939	86,314	44,022	130,336	1,900	7,734	124,502	18,735	105,768
1940	97,232	47,753	144,985	937	7,268	138,654	20,011	118,643
1941	116,908	51,262	168,170	927	6,335	162,762	22,702	140,060
1942	125,002	64,179	189,181	1,448	6,611	184,018	24,611	159,407
1943	147,027	73,943	220,970	1,537	9,729	211,124	25,235	185,889
1944	156,628	74,021	230,645	1,597	6,541	225,701	27,540	198,161
1945*	142,217	80,150	222,367	1,800	4,567	219,600	25,600	194,000

Sources: Federal Power Commission and Edison Electric Institute road and Railway classifications

* Estimated on revised basis which excludes former Mining and Manufacturing and Rail

Production of Electric Energy by Ownership

(In Millions of Kw.-Hr.)

Year	Privately Owned	Government-Owned		
	Electric Utilities	Local†	Federal	Total Government
1931	82,597	4,257	497	4,754
1932	74,488	4,460	445	4,905
1933	76,668	4,614	458	5,072
1934	82,079	4,822	357	5,179
1935	89,330	5,403	555	5,958
1936	102,293	5,951	1,072	7,023
1937	110,464	6,606	1,843	8,449
1938	104,090	6,693	3,029	9,722
1939	115,078	7,088	5,476	12,564
1940	125,411	7,842‡	8,584	16,426
1941	144,290	9,705	10,794	20,498
1942	158,052	11,034	16,893	27,928
1943	180,247	13,027	24,484	37,511
1944	185,850	13,473	28,866	42,339
1945*	180,550	13,277	28,540	41,817

Source: Federal Power Commission state projects.
* Estimated. † Includes cooperatives, power districts.
‡ 1940 and following data revised to exclude production by publically owned transit systems.

For the first time since 1938 there was, in 1945, a decrease in total generation at the nation's power plants. Sharp curtailment of war production after V-J Day caused a decline in the second half of the year that more than offset the slight increase over 1944 that had prevailed during the first half. Peak of war production had been reached late in 1944.

The autumn months, normally ones of accelerated output, reflected in 1945 an opposite, downward trend until storms and frantic Christmas trading sent the curve sharply upward. Strikes and reconversion were also taking a toll. Despite all these adverse factors, the over-all generation was less than 1944 by only 3.6 percent. Even at that the amount topped 1939 by 71.5 percent.

Fuel generation contributed 63.8 percent of the total as contrasted with 68 in 1944 and 66.7 in 1943. Hydro contributed the largest share (36.2 percent) since the slackening years of 1935-1938. It was a good hydro summer.

Privately owned electric utilities generated 81.2 percent of the nation's total output, the federal projects 12.8 percent and the local-government utilities 6.0 percent.

Energy Production by Regions

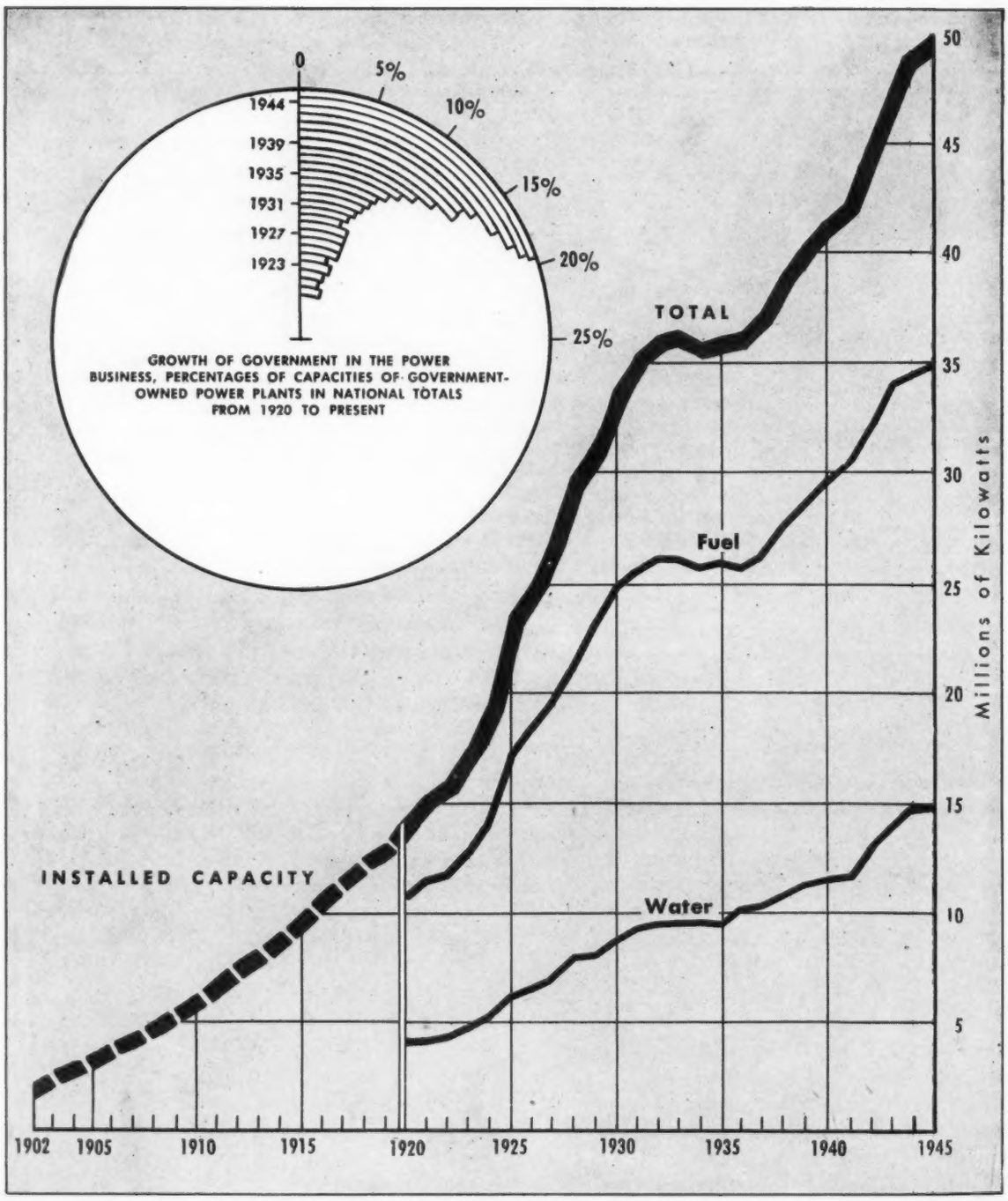
(In Millions of Kw.-Hr.)

Region	1942			1943			1944			1945*		
	Total	Hydro	Fuel	Total	Hydro	Fuel	Total	Hydro	Fuel	Total	Hydro	Fuel
New England	10,677	3,150	7,527	11,647	3,766	7,881	11,988	3,116	8,872	11,819	4,115	7,705
Middle Atlantic	43,087	9,478	33,609	48,857	9,720	39,137	48,196	8,630	39,566	46,601	10,539	36,062
East North Central	43,162	3,499	39,662	50,232	3,554	46,677	53,682	3,002	50,678	50,661	3,354	47,307
West North Central	10,360	2,860	7,499	11,271	2,804	8,467	12,079	2,782	9,297	12,761	3,149	9,612
South Atlantic	23,577	7,117	16,460	26,755	7,826	18,929	27,948	7,237	20,711	28,375	8,032	20,343
East South Central	12,642	8,385	4,257	15,113	10,063	5,050	16,161	10,931	5,230	16,566	12,265	4,302
West South Central	10,111	926	9,185	12,894	899	11,993	14,154	1,053	13,102	13,722	1,501	12,221
Mountain	10,695	9,047	1,648	12,730	11,121	1,609	12,995	11,401	1,594	12,002	10,393	1,610
Pacifi	21,669	19,408	2,261	28,259	23,879	4,380	30,985	25,793	5,192	29,859	26,803	3,056
United States	185,980	63,870	122,108	217,758	73,632	144,125	228,188	73,945	154,242	222,367	80,151	142,218

Source: Federal Power Commission. All data revised to correspond with current basis which excludes former Mining and Manufacturing and Railroad and Railway classifications.
* Estimated.

49,901,000 kw.

CAPACITY



Installed Capacity (In Thousands of Kw.)

Year	Privately Owned	Government-Owned		
	Electric Utilities	Local †	Federal	Total Government
1931	31,498	1,969	230	2,200
1932	32,033	2,122	232	2,354
1933	32,163	2,191	231	2,424
1934	31,547	2,284	288	2,571
1935	31,820	2,316	300	2,615
1936	31,787	2,491	804	3,295
1937	31,958	2,829	833	3,662
1938	33,246	3,090	1,156	4,246
1939	33,908	3,304	1,650	4,955
1940	34,399	3,584‡	1,944	5,528
1941	36,041	3,933	2,371	6,364
1942	37,442	4,395	3,216	7,611
1943	39,128	4,501	4,322	8,823
1944	39,733	4,570	4,886	9,456
1945*	40,185	4,587	5,129	9,716

Source: Federal Power Commission. * Data to November 1. † Includes cooperatives, power districts and state projects. ‡ 1940 and following figures revised to exclude publically-owned transit capacity.

Generating Capacity by Regions (In Thousands of Kw.)

Year	Type of Prime Mover		
	Fuel	Water	Total
1931	25,925	9,445	35,370
1932	26,408	9,583	35,991
1933	26,507	9,736	36,243
1934	26,049	9,742	35,791
1935	26,279	9,795	36,074
1936	26,128	10,436	36,564
1937	26,558	10,577	37,135
1938	27,976	11,066	39,042
1939	28,903	11,415	40,318
1940	29,964	11,675	41,639
1941†	30,588	11,817	42,405
1942	32,211	12,842	45,053
1943	34,067	13,884	47,951
1944	34,603	14,586	49,189
1945*	35,017	14,884	49,901

Source: Federal Power Commission. * Data to November 1. † 1941 and following revised to correspond with current basis which excludes former Mining and Manufacturing and Railroad classifications.

Generating capacity in 1945 crept closer to 50 million kilowatts. The net addition for the year was 712,000 kilowatts, a smaller increment than any year since 1941. Utilities got their war capacity early and it sufficed for the stepped-up needs of 1943 and 1944. Before the fighting which started in Europe in 1939 had ceased the nation had increased its electric production capacity by practically one-quarter.

At the moment fuel generation constitutes 70 percent and hydro 30 percent. The corresponding kw.-hr. outputs were 63.8 and 36.2 percent. Of the total the privately owned utilities possess 80.5 percent and by means of it they contributed 81.2 percent of the total output—publicly owned stations still handle less than one-fifth, however one looks at it.

Lion's share of the 712,000 additional kilowatts accrued to the southern and central regions—all but 11.5 percent went to East South Central, South Atlantic and East North Central regions. Largest percentage increase was the 7.7 percent of East South Central, next was South Atlantic with 6.2 percent and East North Central with 1.3 percent. All other areas report net gains in capacity that do not go above 1 percent.

Generating Capacity by Ownership (In Thousands of Kw.)

REGION	1942			1943			1944			1945*		
	Total	Hydro	Fuel	Total	Hydro	Fuel	Total	Hydro	Fuel	Total	Hydro	Fuel
New England	3,098	891	2,207	3,174	893	2,281	3,189	894	2,295	3,196	894	2,302
Middle Atlantic	10,137	1,596	8,541	10,347	1,587	8,759	10,395	1,593	8,802	10,432	1,591	8,841
East North Central	10,504	726	9,778	11,101	747	10,355	11,317	741	10,577	11,465	739	10,726
West North Central	3,381	569	2,812	3,412	568	2,844	3,461	562	2,899	3,484	562	2,922
South Atlantic	5,677	2,084	3,593	6,016	2,085	3,931	6,258	2,086	4,172	6,502	2,221	4,281
East South Central	2,638	1,635	1,003	3,039	1,850	1,189	3,173	2,022	1,151	3,413	2,189	1,224
West South Central	2,363	301	2,062	2,578	301	2,277	2,648	371	2,277	2,668	371	2,297
Mountain	2,395	1,784	611	2,548	1,924	624	2,627	2,003	625	2,635	2,003	632
Pacific	4,860	3,256	1,605	5,735	3,929	1,806	6,120	4,314	1,806	6,104	4,314	1,780
United States	45,053	12,842	32,211	47,950	13,884	34,067	49,188	14,586	34,604	49,899	14,884	35,017

Source: Federal Power Commission. All data revised to correspond with current basis which excludes former Mining and Manufacturing and Railroad and Railway classifications. * Data to November 1.

Generator Rating — Central Stations, Municipal, Railway and Other Utility Power Plants

Preliminary as of November 1, 1945

Division and State	Number of Companies	Number of Plants	Total Capacity Kilowatts	Generator Capacity in Kilowatts of Plants Operated by [a]					
				Water Power		Steam Power		Internal Combustion Engines	
				Number	Capacity	Number	Capacity	Number	Capacity
UNITED STATES	[b] 1,688	[a] 3,923	49,901,280	1,508	14,884,098	1,078	33,941,306	1,337	1,075,876
NEW ENGLAND	111	313	3,196,561	222	894,071	68	2,280,385	23	22,105
Maine	21	81	332,024	63	246,517	7	82,240	11	3,267
New Hampshire	13	55	302,775	47	233,265	5	67,930	3	1,580
Vermont	20	71	175,639	63	161,397	6	13,550	2	692
Massachusetts	38	68	1,330,392	30	[c] 162,922	33	1,156,225	5	11,245
Rhode Island	6	10	282,921	4	3,250	5	279,450	1	221
Connecticut	13	28	772,810	15	86,720	12	680,990	1	5,100
MIDDLE ATLANTIC	120	372	10,431,825	203	1,590,750	138	8,801,732	31	39,343
New York	59	222	5,360,539	164	1,159,910	44	4,174,650	14	25,979
New Jersey	14	25	1,571,447	3	7,270	17	1,560,240	5	3,937
Pennsylvania	47	125	3,499,839	36	423,570	77	3,066,842	12	9,427
EAST NORTH CENTRAL	316	678	11,464,440	297	738,704	248	10,596,898	133	128,838
Ohio	68	106	3,250,870	6	11,525	79	3,221,979	21	17,366
Indiana	53	83	1,569,042	21	35,444	47	1,517,935	15	15,663
Illinois	61	95	3,057,360	12	49,414	60	2,985,589	23	22,357
Michigan	67	198	2,381,751	131	364,751	29	1,968,375	38	48,625
Wisconsin	67	196	1,205,417	127	277,570	33	903,020	36	24,827
WEST NORTH CENTRAL	489	893	3,484,629	138	561,962	224	2,537,203	531	385,464
Minnesota	82	158	745,351	45	126,254	48	567,064	65	52,033
Iowa	96	181	761,236	32	132,526	48	530,625	101	98,085
Missouri	75	119	846,475	7	150,550	32	633,318	80	62,607
North Dakota	17	42	100,170	.....	.....	17	89,338	25	10,832
South Dakota	45	76	93,198	5	3,270	11	55,112	60	34,816
Nebraska	87	180	417,671	42	142,625	34	220,266	104	54,780
Kansas	87	137	520,528	7	6,737	34	441,480	96	72,311
SOUTH ATLANTIC	147	392	6,502,496	160	2,221,315	122	4,189,065	110	92,116
Delaware	6	8	38,912	.....	.....	4	33,200	4	5,712
Maryland	13	29	899,899	3	271,325	13	619,525	13	9,049
District of Columbia	2	3	458,000	1	3,000	2	455,000	.....	.....
Virginia	23	68	796,271	37	182,041	15	599,505	16	14,725
West Virginia	11	36	960,805	11	100,940	15	855,110	10	4,755
North Carolina	30	80	1,349,624	49	657,780	20	679,221	11	12,623
South Carolina	16	44	792,469	28	650,644	10	137,330	6	4,495
Georgia	15	48	656,376	27	342,392	15	311,150	6	2,334
Florida	31	76	550,140	4	12,693	28	499,024	44	38,423
EAST SOUTH CENTRAL	65	156	3,413,689	39	2,189,440	66	1,201,329	51	22,920
Kentucky	17	37	554,241	4	206,860	25	344,701	8	2,680
Tennessee	17	40	1,452,402	23	1,023,017	12	427,520	5	1,866
Alabama	7	32	1,330,373	12	959,563	12	366,740	8	4,070
Mississippi	24	47	76,672	.....	.....	17	62,368	30	14,304
WEST SOUTH CENTRAL	180	406	2,668,524	36	370,847	96	2,075,443	274	222,234
Arkansas	25	42	222,040	6	102,008	13	102,845	23	17,187
Louisiana	37	63	542,469	.....	.....	10	494,520	53	47,949
Oklahoma	53	105	457,068	4	59,224	23	343,618	78	54,226
Texas	65	196	1,446,947	26	209,615	50	1,134,460	120	102,872
MOUNTAIN	187	419	2,634,448	198	2,002,535	68	524,281	153	107,632
Montana	21	40	373,432	22	358,274	4	11,968	14	3,190
Idaho	16	55	267,578	44	263,856	1	400	10	3,322
Wyoming	31	50	82,711	14	49,440	11	27,537	25	5,734
Colorado	42	86	326,825	30	86,585	25	223,344	31	16,896
New Mexico	24	47	154,064	5	25,010	14	107,607	28	21,447
Arizona	18	50	668,274	15	540,790	9	84,675	26	42,809
Utah	27	76	171,407	58	92,445	4	68,750	14	10,212
Nevada	8	15	590,157	10	586,135	.....	.....	5	4,022
PACIFIC	73	294	6,104,668	215	4,314,474	48	1,734,970	31	55,224
Washington	23	61	1,823,625	44	1,619,280	10	202,320	7	2,025
Oregon	23	71	902,426	51	713,029	12	184,550	8	4,847
California	27	162	3,378,617	120	1,982,165	26	1,348,100	16	48,352

Source: Federal Power Commission

Notes: [a] For the approximately 180 combination plants each type of prime mover is counted as a separate plant..... [b] Total includes 82 duplications because of utilities having generating plants in more than one state..... [c] Includes 1,000 kilowatts wind power.

rate of increase nears pre-war

CUSTOMERS

In the three years before Hitler attacked Poland in September, 1939, electric utility customers increased in number at a rate between 2 and 3 percent annually.

Then, in the two years before this country entered the war, 1940 and 1941, the rate jumped up, went to 4.5 percent in the latter year.

During our first three years of war, 1942, 1943 and 1944, increase in customers slowed materially, below 2 percent annually, with a low of 0.6 percent in 1943.

Now the rate is accelerating; the estimated increase for 1945 is 2.6 percent, back in the range of the 1937-1939 period.

Fastest increase in customer growth in 1944 occurred in the East and West South Central regions, the area on each side of the Mississippi and south of the line of the Ohio. Again in 1945 these regions lead the country and at a faster pace.

The far western regions show somewhat more rapid rates of growth than do the eastern and northern, but the differences are not large.

A casualty of our first two years of war was a decrease in number of commercial and industrial customers, 2 percent annually.

That trend reversed in 1944, turned more sharply upward in 1945, and at present the number of customers in this class is about 2 percent more than in 1941.

Analysis of relationship between increases in residential and in commercial and industrial customers in 1945 shows that for the country as a whole 4.3 residential customers were added for each commercial and industrial.

Well above this national average are the West North Central, South Atlantic and East South Central regions with 7, 8.2 and 8.9 respectively. This seems to indicate that these regions are lagging behind the rest of the nation in post-war business activity because they are adding commercial and industrial customers much less rapidly in proportion to addition of residential customers than are the other six regions, whose proportions are below the average.

Central Station Customers at End of Year

	United States	New England	Middle Atlantic	East No. Central	West No. Central	South Atlantic	East So. Central	West So. Central	Mountain	Pacific
Total Customers										
1945	33,900,000	2,630,700	8,232,050	7,814,650	3,183,600	3,443,925	1,582,730	2,363,350	1,008,635	3,640,360
1944	33,048,392	2,579,271	8,083,415	7,657,816	3,099,853	3,329,679	1,513,261	2,249,398	977,471	3,528,228
Change	851,608	51,429	148,635	156,834	83,747	114,246	69,469	113,952	31,164	82,132
Rural Customers†										
1945	1,220,000	8,400	58,000	335,000	138,000	98,000	74,000	128,000	23,000	357,600
1944	1,144,241	7,965	57,719	325,872	124,491	88,824	76,256	109,796	20,076	333,242
Change	75,759	435	281	9,128	13,509	9,176	−2,256	18,204	2,924	24,358
Residential Customers										
1945	28,000,000	2,275,000	7,000,000	6,548,000	2,550,000	2,862,000	1,305,000	1,870,000	830,000	2,760,000
1944	27,371,260	2,234,280	6,888,024	6,429,881	2,488,304	2,768,616	1,240,452	1,797,525	807,429	2,716,749
Change	628,740	40,720	111,976	118,119	61,696	93,384	64,548	72,475	22,571	43,251
Commercial & Industrial										
1945	4,562,000	340,000	1,152,000	907,000	484,000	473,000	194,000	353,000	153,000	506,000
1944	4,415,047	329,837	1,115,204	877,768	475,208	461,592	186,777	329,937	147,311	491,413
Change	146,953	10,163	36,796	29,232	8,792	11,408	7,223	23,063	5,689	14,587
Municipal, Rail & Misc.										
1945	118,000	7,300	22,050	24,650	11,600	10,925	9,730	12,350	2,635	16,760
1944	117,844	7,189	22,468	24,295	11,850	10,647	9,776	12,140	2,655	16,824
Change	156	111	−418	355	−250	278	−46	210	−20	−64

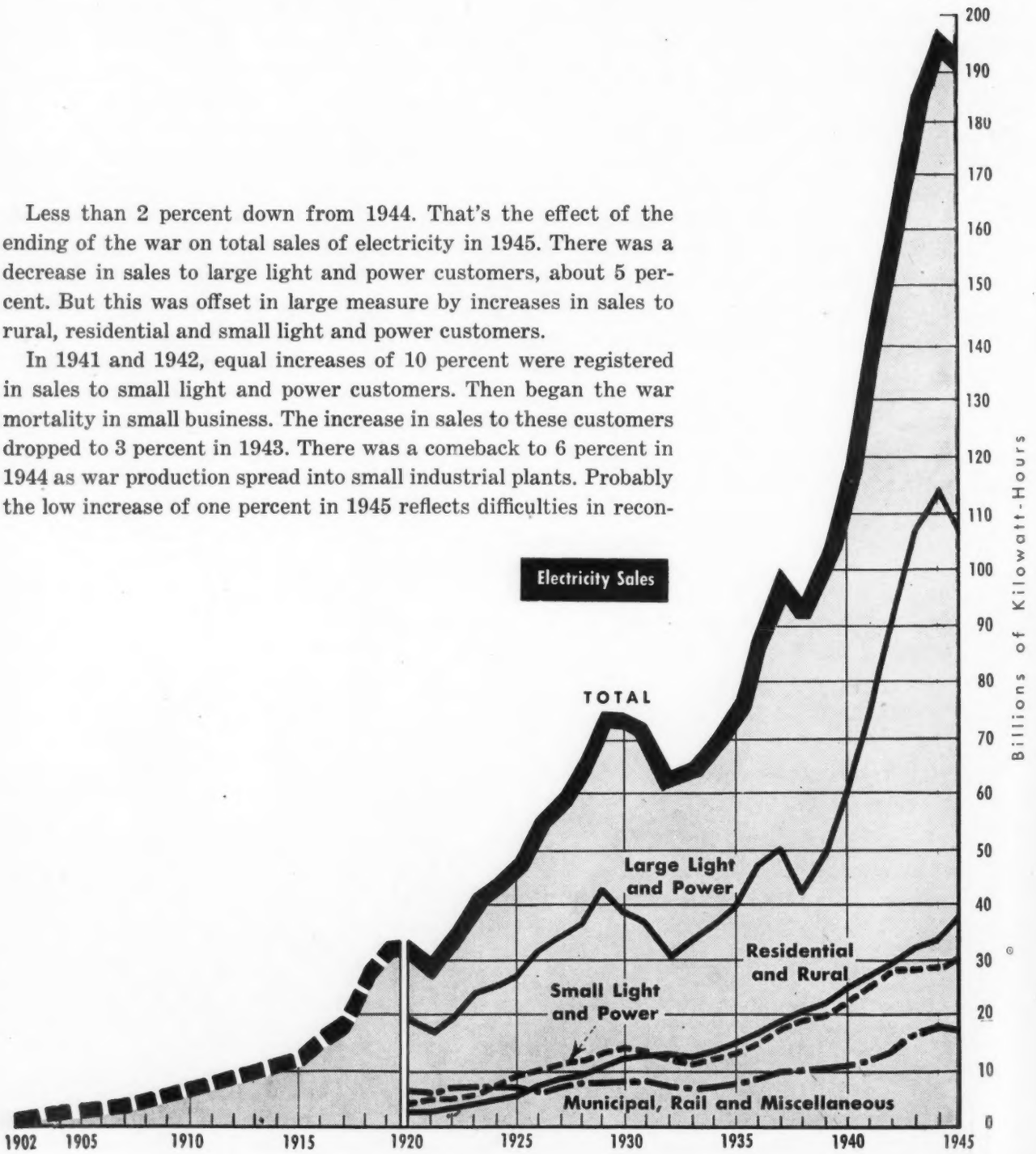
*1945 Estimated. †Customers served on specific rural rates. Rural customers served on urban rates not included.

194,000,000,000 kw.-hr.

ENERGY SALES

Less than 2 percent down from 1944. That's the effect of the ending of the war on total sales of electricity in 1945. There was a decrease in sales to large light and power customers, about 5 percent. But this was offset in large measure by increases in sales to rural, residential and small light and power customers.

In 1941 and 1942, equal increases of 10 percent were registered in sales to small light and power customers. Then began the war mortality in small business. The increase in sales to these customers dropped to 3 percent in 1943. There was a comeback to 6 percent in 1944 as war production spread into small industrial plants. Probably the low increase of one percent in 1945 reflects difficulties in recon-



version in these small plants.

The figures of sales for street and highway lighting show such small increases as to suggest that recovery from the dimout phychology of wartime is yet far from complete and that sales effort in this field is not yet showing results.

It is proverbial in the industry that usage of electricity by residential customers is less affected by external conditions than are sales to industrial customers; the load is the most stable of those to any large class of customers. The 1945 record of residential sales corroborates this view.

Energy Sales to Ultimate Consumers (In Millions of Kw.-Hr.)

Year	Rural	Residential	Small Light and Power	Large Light and Power	Street and Highway Lighting	Street and Interurban Electric Railways	Electrified Divisions of Steam Railroads	Municipal and Miscellaneous	Total to Ultimate Consumers
1932	1,579	11,494	12,106	30,965	2,033	4,040	568	926	63,711
1933	1,633	11,358	11,589	33,857	1,893	3,991	668	927	65,916
1934	1,858	12,233	12,278	36,943	1,896	4,237	692	945	71,082
1935	1,693	13,496	13,588	40,864	2,078	4,194	841	842	77,596
1936	2,138	14,992	15,612	48,655	2,223	4,401	1,115	908	90,044
1937†	1,670	17,691	18,075	51,360	1,863	4,428	1,284	2,987	99,359
1938	1,577	19,371	19,137	43,140	1,929	3,989	1,449	3,138	93,731
1939	1,881	21,084	20,722	51,108	2,002	3,918	1,847	3,205	105,768
1940	1,991	23,318	22,373	59,557	2,048	3,974	1,935	3,447	118,643
1941	2,352	25,124	24,628	76,060	2,111	3,960	2,118	3,707	140,060
1942	2,890	26,937	27,234	88,378	2,061	4,256	2,372	5,280	159,408
1943	2,996	28,621	28,192	106,657	2,075	4,696	2,530	10,122	185,889
1944	3,373	31,266	29,837	115,187	2,163	4,635	2,694	9,006	198,161
1945*	3,650	34,100	30,250	108,450	2,185	4,650	2,615	8,100	194,000

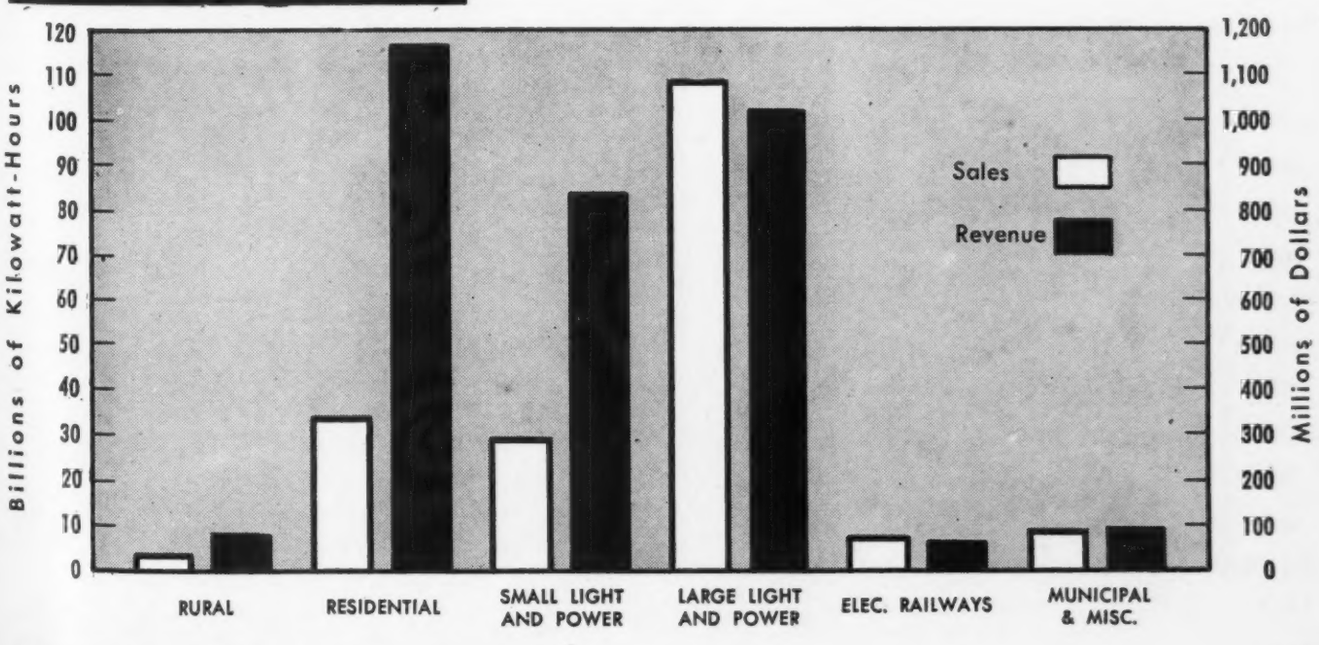
Source: Edison Electric Institute. * Estimated. † Revised figures to conform with Uniform System of Accounts prescribed by Federal Power Commission from 1937.

With sales effort entirely absent during the war years, energy used by these customers continued to increase, and at a faster rate than when selling was in the picture. But it would be a mistake to conclude from this that sales effort is unnecessary to keep residential load growing. Probably this load did not grow at all, or if it did, only a little, during the war. The increase in sales resulted from more use of existing equipment, not from additions to load in customers' homes.

Taking 1937 as a base, the index for residential sales rises in practically a straight line in about 10-point jumps through 1943. Then the line becomes steeper, with 15-point rises in 1944 and 1945. The trend of rural sales is about parallel.

With electrical appliances becoming more easily obtainable in 1946, one may expect to see the sales to residential customers rising on an even steeper trend than in 1944 and 1945 and the average kw.-hr. per residential customer going up in even larger jumps than the 75 kw.-hr. increase that brought the figure to 1,225 in the past year.

Energy Sales by Classes of Consumers, 1945



$3,334,000,000

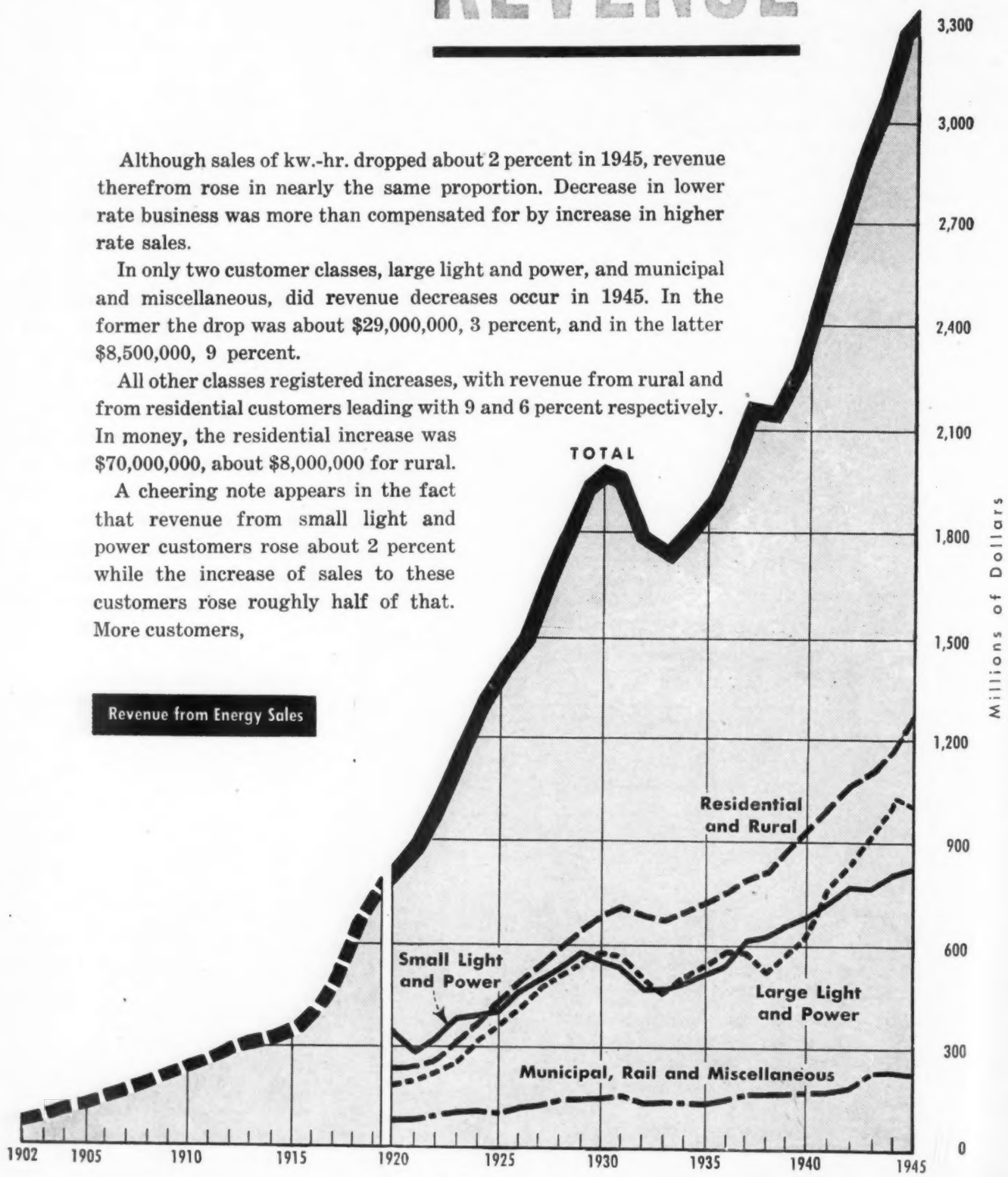
REVENUE

Although sales of kw.-hr. dropped about 2 percent in 1945, revenue therefrom rose in nearly the same proportion. Decrease in lower rate business was more than compensated for by increase in higher rate sales.

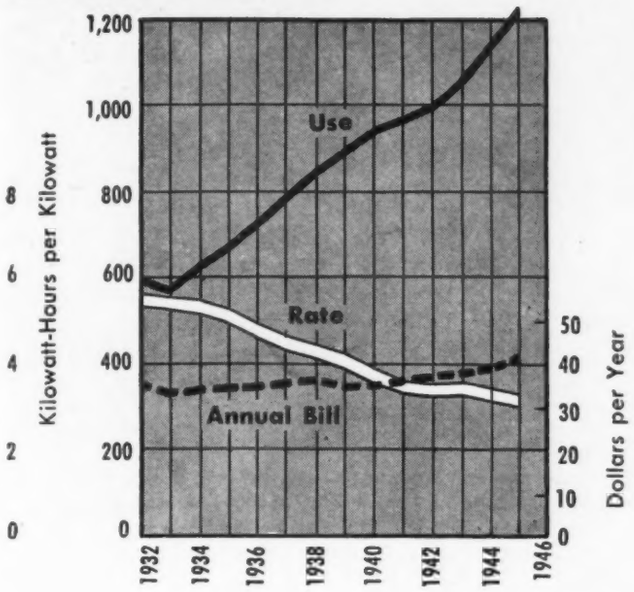
In only two customer classes, large light and power, and municipal and miscellaneous, did revenue decreases occur in 1945. In the former the drop was about $29,000,000, 3 percent, and in the latter $8,500,000, 9 percent.

All other classes registered increases, with revenue from rural and from residential customers leading with 9 and 6 percent respectively. In money, the residential increase was $70,000,000, about $8,000,000 for rural.

A cheering note appears in the fact that revenue from small light and power customers rose about 2 percent while the increase of sales to these customers rose roughly half of that. More customers,



Averages for Residential Service



Residential Service to Urban and Non-Farm Homes

Year	Kw.-Hr. per Customer	Average Annual Bill (Dollars)	Revenue per Kw.-Hr. (Cents)
1933	600	33.12	5.52
1934	624	33.07	5.30
1935	672	33.53	4.99
1936	727	33.81	4.65
1937	805	34.62	4.30
1938	853	35.31	4.14
1939	897	35.88	4.00
1940	952	36.56	3.84
1941	986	36.78	3.73
1942	1,012	37.51	3.67
1943	1,070	38.50	3.60
1944	1,151	40.40	3.51
1945*	1,225	41.90	3.42

Source: Edison Electric Institute. *Estimated.

as is shown on another page of this issue, is the answer, their purchases of energy on beginning steps of rates.

The revenue increase in the residential customer class is approximately the same as it was in 1944. But, different from small light and power customers, the residential group paid a lower average price for their kw.-hr. than in 1944. The average is now down to 3.42 cents as against 3.52 in the previous year.

The average annual residential bill is up to $1.50 from 1944. Since average energy usage increased 75 kw.-hr., the residential customer paid only two cents per unit for the additional energy he used in 1945.

The increase in average revenue per kw.-hr. in small light and power sales in 1945 was 0.4 mill. Large light and power customers on the average paid 0.3 mill per unit more in 1945. From these examples appears the reason why the 1945 decreases in total energy sales had no corresponding effects on total revenue.

Revenue from Electricity Sales

(Thousands of Dollars)

Year	Rural‡	Residential	Small Light and Power	Large Light and Power	Street and Highway Lighting	Street and Interurban Electric Railways	Electrified Divisions of Steam Railroads	Municipal and Miscellaneous	Total from Ultimate Consumers
1932	47,127	640,384	500,993	474,424	89,828	36,701	6,181	18,076	1,813,717
1933	46,501	623,797	471,780	468,389	83,097	35,098	6,658	19,243	1,754,366
1934	49,182	648,801	490,420	499,451	81,846	36,402	6,680	19,085	1,831,870
1935	48,404	673,526	519,213	531,106	79,429	36,431	7,944	15,933	1,911,988
1936	59,286	696,997	562,122	581,148	80,791	37,423	9,591	17,225	2,044,586
1937†	37,726	759,824	616,438	583,197	72,740	37,019	10,761	43,091	2,160,798
1938†	38,928	802,532	632,091	518,694	74,323	33,512	11,995	44,504	2,156,580
1939†	45,484	843,158	660,683	572,659	75,443	32,573	14,427	45,154	2,289,583
1940†	49,473	895,951	689,253	631,428	76,052	32,740	15,068	50,252	2,440,218
1941	64,396	938,229	725,117	758,083	76,949	32,471	16,474	53,338	2,665,057
1942	75,027	990,185	767,279	828,318	75,660	35,343	18,289	65,742	2,885,843
1943	76,617	1,029,260	769,490	968,378	75,384	38,278	19,820	100,415	3,077,643
1944	82,842	1,097,726	817,355	1,043,392	76,626	38,672	21,602	98,537	3,276,752
1945*	90,000	1,167,000	835,000	1,014,000	77,000	39,000	22,000	90,000	3,334,000

Source: Edison Electric Institute. *Estimated. †Uniform System of Accounts prescribed by Federal Power Commission begins new series of figures in 1937
‡Specific rural rates only.

claiming still more of revenue

EXPENSES

Ten years ago in 1935 operating expenses before taxes took 36.9 percent of electricity sales revenue. In 1945 the proportion had risen to 41.3 percent. Considering the times, the increase from 36.9 to 41.3 percent is not inordinate, neither is it pleasant to reflect on overmuch.

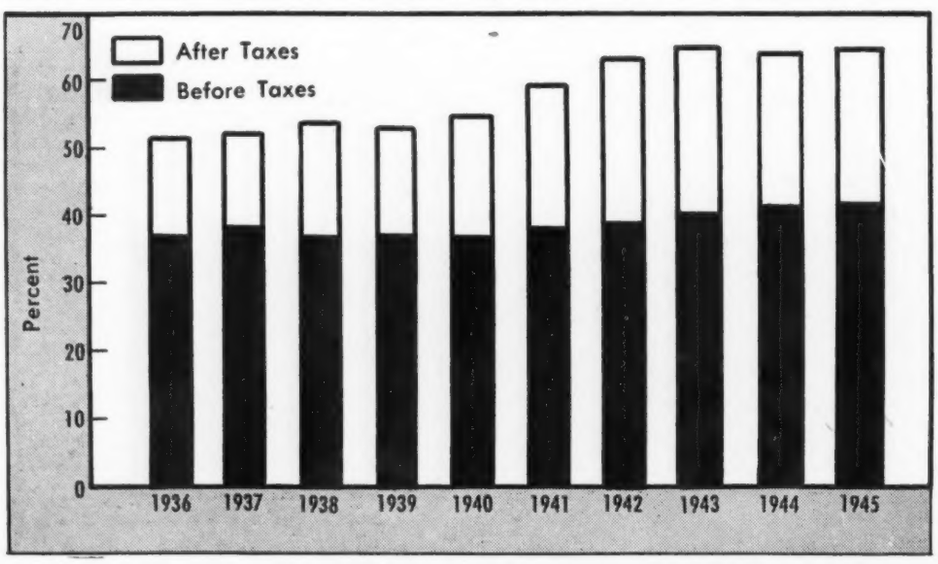
More disturbing is the increase in operating ratio after taxes, which was 50.9 percent in 1935 and 64.2 in 1945. Indicating the growth of taxes as a cost element are the facts of ten-year increases in operating ratios before and after taxes of 4.4 and 13.3 percent respectively, a large difference.

Increased taxes made costs rise three times as fast as did increases in wages, fuel, and supplies. And it is significant that the fastest increase of the tax element in cost occurred before this nation entered the war.

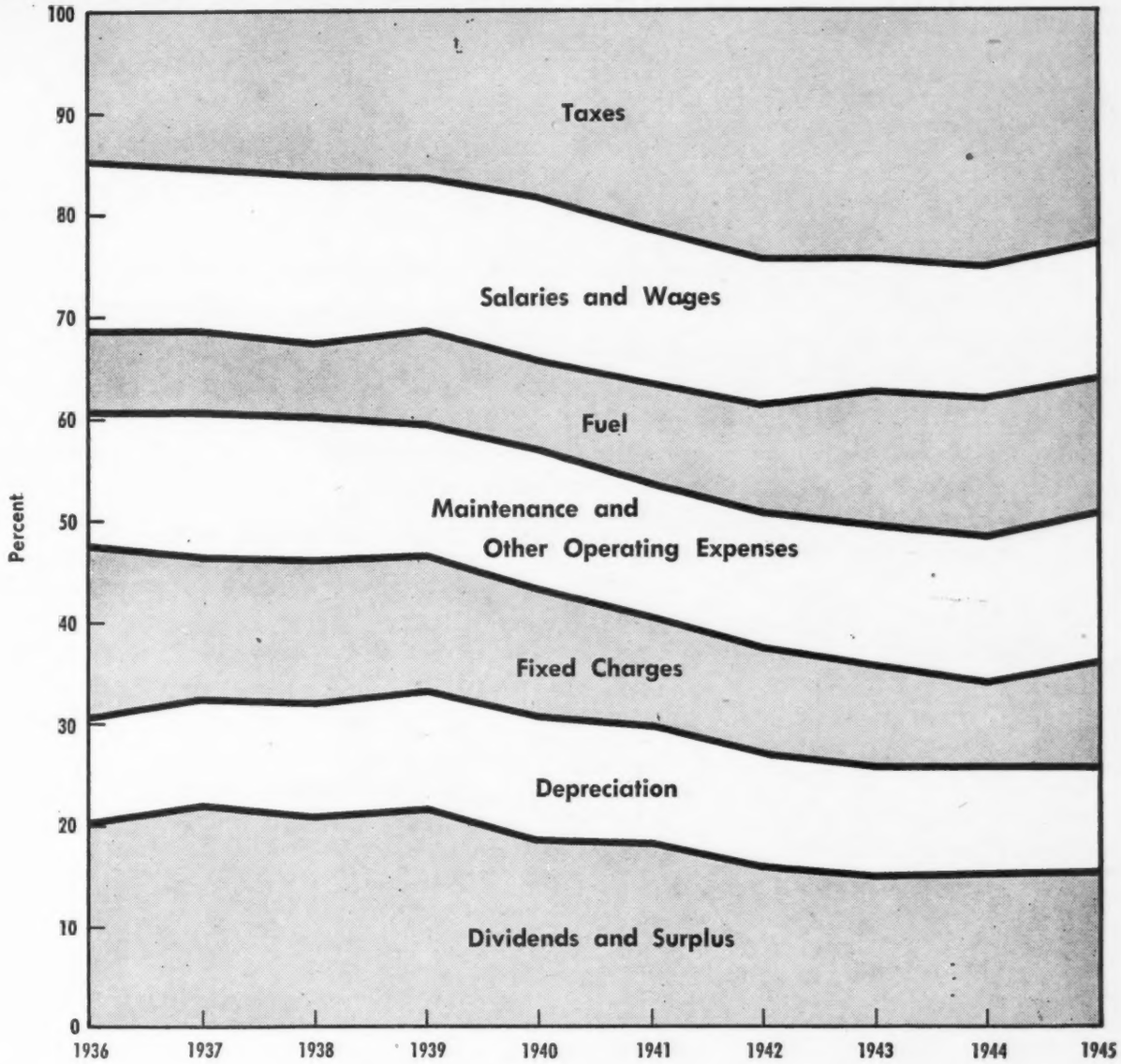
In the ten years, 1936-1945 inclusive, notable changes are to be seen in the proportions of shares in the revenue dollar. See the accompanying graph from whose data the ratios quoted here are taken. Salaries and wages dropped from a 16.6-percent

Operating Ratio Before and After Taxes Electric Utility Companies

	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945
Before Taxes	37.3	38.5	37.3	37.4	37.5	38.4	38.7	40.0	41.0	41.3
After Taxes	52.2	53.8	54.2	53.3	55.3	59.4	62.9	64.2	63.6	64.2



Distribution of Electricity Sales Revenue Dollar, 1936-1945



to a 13.3-percent share; dividends and surplus from 20.2 to 15.4 percent; fixed charges from 17 to 9.1. The only element that is about the same in 1945 (10.8 percent) as it was in 1936 (10.2 percent) is depreciation.

All the other sharers of the revenue dollar increased their proportionate takes in the ten years. Taxes rose from 14.7 to 22.8 percent, with a high of 24.9 in 1944. Fuel cost increased from 8.1 to 13 percent; maintenance and miscellaneous operating expenses from 13.2 to 15 percent.

Operating Revenue, Expenditures, Taxes

Privately owned Establishments*
(In Millions of Dollars)

Year	Operating Revenue	Operating Expenditures	Taxes
1936.....	1,911	721	281
1937.....	2,031	781	308
1938.....	2,018	762	323
1939.....	2,148	798	352
1940.....	2,277	863	404
1941.....	2,467	947	520
1942.....	2,609	1,002	628
1943.....	2,816	1,127	680
1944.....	2,955	1,225	677
1945†.....	3,000	1,240	683

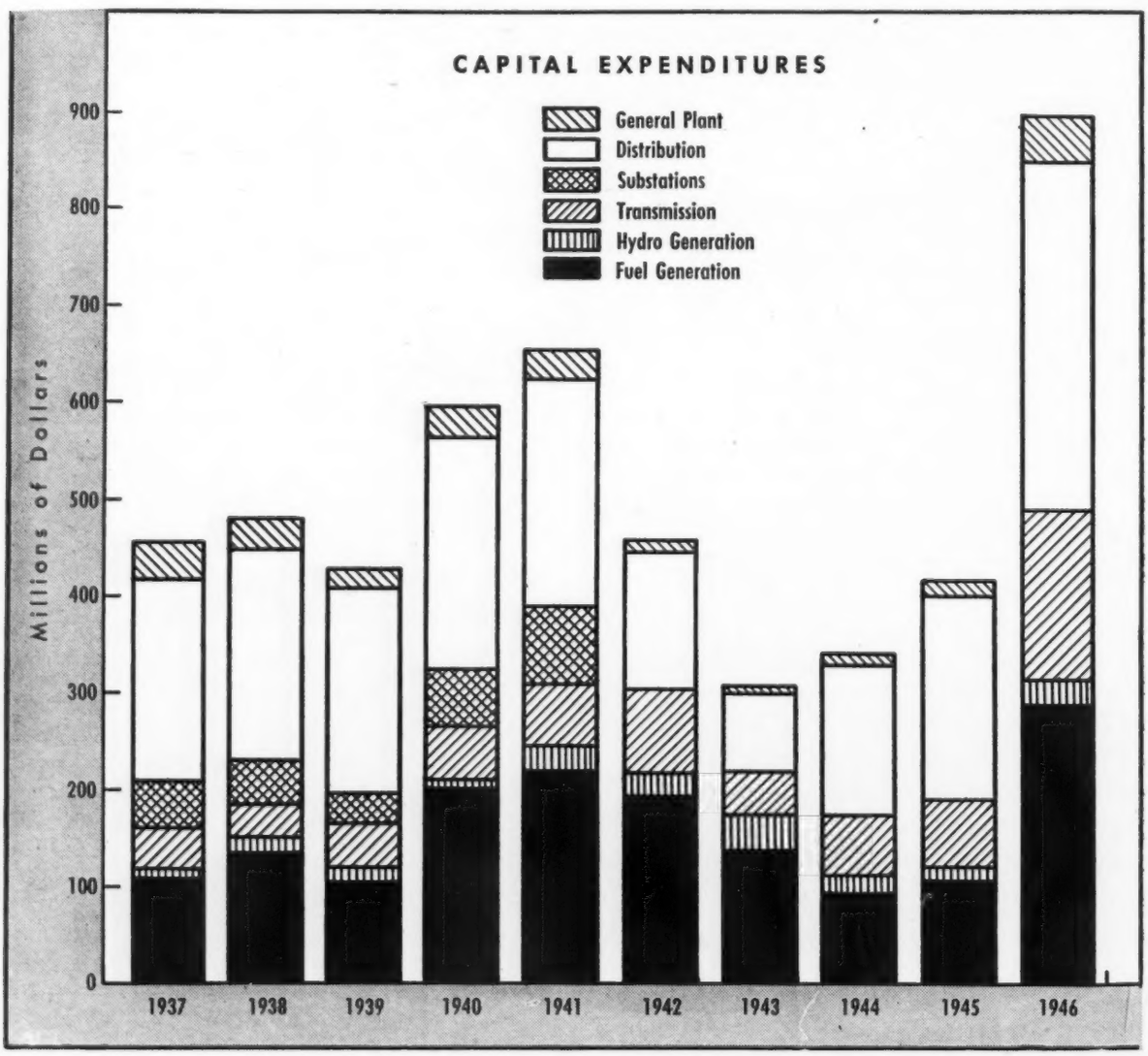
Source: Edison Electric Institute.
* Date adjusted to cover only utilities operating as private enterprises on December 31, 1941.
† Subject to year-end revisions.

nearly a billion dollars

BUDGET

About $900,000,000, next to the highest budget in the history of the industry, $919,000,000 in 1930, is indicated by reports to "Electrical World" as the expenditure in 1946 for capital construction by electricity supply undertakings directly serving the public. To be added to this is an estimate of something under $100,000,000 for 1946 expenditures by the federal government in power facilities, based on reports from government agencies. Thus it can be said that the makers and suppliers of equipment and material for power system construction have a market of nearly a billion dollars in 1946.

Another perspective on the proposed capital ex-



penditure for new construction in 1946 comes from comparison with the average for past years. In the 15 years, 1931-1945 inclusive, the utilities laid out an average sum of $384,730,000 annually for additions to plants, lines and other facilities. The 1946 figure is nearly two and one half times that 15-year average.

There are two cautionary clauses to be inserted into any consideration of the 1946 budget. One is the possibility that the electric utilities will not be able to obtain all of the material and equipment that is represented in their estimates of 1946 expenditures. During the war years utility buying in general had a high priority rating. For 1946 construction, the utilities must buy in a market wide open to all comers. Present interferences with resumption of large scale industrial production presage scarcities of capital goods in 1946 that will probably make it difficult for the utilities to secure all that is needed to carry out their building plans completely.

The second caution refers to the probability that expenditures for 1946 were generously estimated in order to cover anticipated higher costs of goods and labor. Thus, while the amount of money is close to the highest budget, that of 1930, it is not likely that anywhere near comparable quantities of equipments and materials will be used in 1946.

As has been the case in every year since 1926, except for 1942 and 1943 when the hand of war lay heaviest on system improvement and expansion, distribution is again the largest budget item, 40 percent of the total. Next comes the money dedicated to increase in production facilities in fuel and hydro plants, 35 percent. Transmission takes 9 percent and general plant the remaining 6.

The increase in estimate for production, $313,000,000 in 1946, approaching three times the $119,000,000 in 1945, furnishes additional proof, if any is needed, that the war's end found the electric utilities with no excess of generating capacity.

Capital Expenditures, 1945

As reported to ELECTRICAL WORLD (Thousands of Dollars)

Regions	Fuel Stations	Hydro Stations	Transmission	Distribution	General Plant	Total Plant	Substations†
New England..	6,968	985	4,308	13,085	830	26,176	3,847
Middle Atlantic	30,517	593	11,274	31,534	2,060	75,978	5,162
E. N. Central..	30,350	175	12,420	42,335	5,089	90,369	7,271
W. N. Central..	6,317	188	9,312	14,025	1,535	31,377	4,345
South Atlantic.	11,710	927	6,598	29,000	1,416	49,651	7,302
E. S. Central...	2,276	36	1,219	13,403	1,100	18,034	1,378
W. S. Central..	14,067	7	9,444	20,815	3,410	47,743	4,447
Mountain.....	2,529	1,637	2,443	7,395	518	14,522	2,223
Pacific.....	1,432	8,165	11,917	32,900	665	55,079	10,695
Total U.S.A....	106,166	12,713	68,935	204,492	16,623	408,929	46,670

Prospective Capital Expenditures, 1946

As reported to ELECTRICAL WORLD (Thousands of Dollars)

New England..	27,000	962	8,119	27,000	5,600	68,681	9,667
Middle Atlantic	70,350	1,185	30,400	56,500	8,700	167,135	17,765
E. N. Central..	64,825	112	34,000	79,270	14,700	192,907	21,315
W. N. Central..	35,780	1,254	25,700	23,925	4,950	91,609	10,918
South Atlantic.	23,243	257	18,406	50,463	5,035	97,404	12,906
E. S. Central...	9,163	405	4,266	25,196	1,211	40,241	3,078
W. S. Central..	36,613	7	17,445	30,718	4,822	89,605	9,285
Mountain.....	4,111	8,824	7,407	12,239	950	33,531	9,742
Pacific.....	16,645	12,485	27,800	52,825	4,165	113,920	23,275
Total U.S.A....	287,730	25,491	175,543	358,136	50,133	895,033	117,951

*Covers Power Companies, State Authorities and Municipal Plants. Excludes REA, TVA, Reclamation Bureau and Other Federal Projects.
†Substation expenditures included in transmission and distribution plant.

Annual Capital Expenditures for New Construction

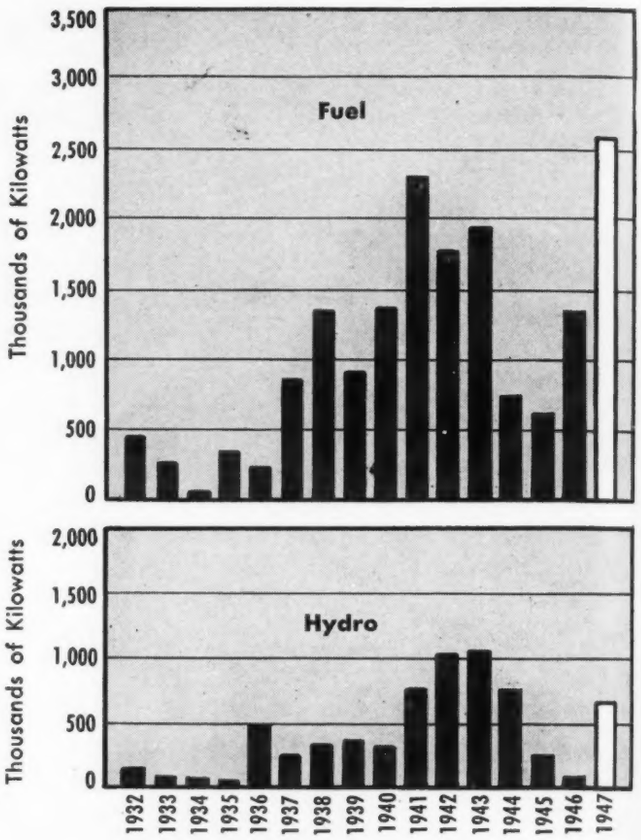
Electric Light and Power Industry (In Thousands of Dollars)

Year	Fuel	Hydro	Transmission	Substations*	Distribution	General Plant	Total
1931.....	104,386	60,317	101,031	187,564	182,158	61,284	596,740
1932.....	40,000	20,000	60,000	30,000	110,000	25,000	285,000
1933.....	10,400	4,000	16,100	14,900	72,200	11,700	129,300
1934.....	10,258	5,704	30,180	11,921	76,299	13,292	147,654
1935.....	16,172	6,337	35,349	14,766	103,104	17,127	192,855
1936.....	36,820	9,030	20,170	25,050	174,640	24,000	289,710
1937.....	113,060	10,540	40,740	49,290	203,250	38,600	455,480
1938.....	133,000	17,600	36,000	46,400	215,000	34,000	482,000
1939.....	101,500	17,900	45,500	31,750	210,500	22,850	430,000
1940.....	200,430	9,270	55,900	57,760	237,700	35,520	596,580
1941.....	219,741	27,186	62,476	79,218	232,840	32,687	654,148
1942†.....	191,671	22,847	85,633	.....	144,180	11,644	455,975
1943.....	137,059	35,505	42,923	32,740	84,683	6,066	306,286
1944.....	96,126	19,888	61,196	40,663	151,969	11,105	340,284
1945.....	106,166	12,713	68,935	46,670	204,492	16,623	408,929
1946‡.....	287,730	25,491	173,543	117,951	358,136	50,133	895,033

*After 1941, substation expenditures, although separately stated, are included in figures for transmission and distribution.
†Expenditure study not made by "Electrical World" in 1942. Figures are those reported by Federal Power Commission for privately owned utilities only.
‡Prospective.

5,637,661 Kw.

NEW CAPACITY



Over 800,000 more kilowatts in additions to generating capacity are seen ahead as the 1946 corner is turned than was the case a year ago. Then the forward look at capacity additions showed 4.8 million to be installed in 1945 and later. Now, for 1946 and later, the ante is raised to over 5.6 million.

Of the future additions to generating capacity reported here, about 25 percent is in the field of government ownership and of this about two thirds is water power. Plants of the power companies on the other hand include very little water power, only about 3 percent of their contemplated capacity additions.

Last year in these pages, new capacity of 1,297,051 kw. for 1945 was reported. The report this year says that 75 percent of that capacity, 887,400 kw., was actually added. Undoubtedly the ending of the war was the cause of this reduction.

At the end of 1944, the power companies had plans ahead for the addition of over 3 million kw. in 1945 and later. Their plans for 1946 and later contemplate the addition of over 4 million kw. Of this increase probably around a third is carryover from 1945.

It is likely that a significant proportion of the new capacity reported here is for the purpose of enlarging reserve margins that in some cases were uncomfortably narrowed during the war years.

New Capacity Added Each Year

Year	Kilowatts		
	Fuel	Hydro	Total
1931	836,500	566,500	1,403,000
1932	466,300	126,155	592,455
1933	251,025	95,325	346,350
1934	52,805	41,900	94,705
1935	347,140	38,950	386,090
1936	231,828	489,865	721,093
1937	873,414	245,346	1,118,760
1938	1,350,303	345,605	1,695,808
1939	914,680	370,150	1,284,830
1940	1,361,094	332,016	1,693,110
1941	2,292,215	786,250	3,078,375
1942	1,756,212	1,026,900	2,783,112
1943	1,835,180	1,088,900	2,924,080
1944	778,037	767,855	1,545,892
1945	621,600	265,800	887,400
1946*	1,383,011	79,300	1,462,311
1947*	2,596,450	691,500	3,287,950

Source: "Electrical World" Surveys.
* Prospective.

Also some of the new capacity will be used to replace older equipment. But even after making reasonable deductions on these accounts there still remains a large accretion to production facilities that represents growth of the industry.

Generating Capacity added in 1945

STEAM

Private Companies	Kw. (Nameplate)
Albuquerque Gas & Electric Co.	7,500
Boston Edison Co.	50,000
Commonwealth Edison Co. & Subs.	50,000
Dallas Power & Light Co.	25,000
Delaware Power & Light Co. & Subs.	7,500
Georgia Power Co.	60,000
Gulf Power Co.	22,500
Lynn Gas & Electric Co.	10,000
Mississippi Power Co.	22,500
Mountain States Power Co.	3,000
New York State Electric & Gas Corp.	30,000
Northwestern Public Service Co.	7,500
Ohio Power Co.	100,000
Potomac Electric Power Co.	50,000
Public Service Co. of Indiana, Inc.	50,000
Southern Indiana Gas & Electric Co.	22,500
	518,000
Municipal and Other Public Plants	
Colorado Springs, Colorado	5,000
Fairmont, Minnesota	4,000
Marshfield, Wisconsin	4,000
San Antonio, Texas	25,000
Tennessee Valley Authority	60,000
	98,000

HYDRO

Private Companies	Kw. (Nameplate
Alpena Power Co.	300
Municipal and Other Public Plants	
Bureau of Reclamation	1,500
Tacoma, Washington	65,000
Tennessee Valley Authority	199,000
	265,500

INTERNAL COMBUSTION

Private Companies	
California Oregon Power Co.	775
California Pacific Utilities Co.	900
Consumers Public Service Co.	200
Idaho Power Co.	100
Sioux City Gas & Electric Co.—Iowa P. S. Co. System.	1,125
	3,100
Municipal and Other Public Plants	
Carthage, Missouri	2,500

Kind of Power	Private Companies	Municipal and Federal	Total
Steam	518,000	98,000	616,000
Hydro	300	265,000	265,000
Int. Comb.	3,100	2,500	5,600
Totals	521,400	366,000	887,400

Generating Capacity to Be Added in 1946

STEAM

	Kw. (Nameplate)
Arkansas Power & Light Co.	30,000
Atlantic City Electric Co.	25,000
Central Illinois Electric & Gas Co.	40,000
Central Power & Light Co.	20,000
Commonwealth Edison Co. & Subs.	107,000
Consolidated Edison Co. of N. Y. & System Cos.	72,500
Detroit Edison Co.	75,000
Electric Advisers (Ohio Properties)	60,000
Florida Power Corp.	25,000
Great Northern Utilities Co.	3,000
Gulf States Utilities Co.	35,000
Houston Lighting & Power Co.	37,500
Indianapolis Power & Light Co.	37,500
Interstate Power Co.	15,000
Long Island Lighting System	29,500
Metropolitan Edison Co.	40,000
Missouri Utilities	5,000
New England Gas & Electric System	20,000
New England Power System Cos.	40,000
Northern States Power Co. & Subs. (Minn.)	10,000
Northern States Power Co. (Wisc.)	12,500
Ohio Public Service Co.	50,000
Otter Tail Power Co.	10,000
Pacific Gas & Electric Co.	5,000
Philadelphia Electric Co. & Subs.	162,500
Public Service Co. of Okla.	20,000
Scranton Electric Co.	25,000
Sioux City Gas & Electric Co.—Iowa P. S. Co. System.	20,500
Southwestern Public Service Co.	27,500
Staten Island Edison Co.	20,000
United Illuminating Co.	6,000
West Penn Power Co. & Subs.	65,000
Wisconsin Power & Light Co.	25,000
Wisconsin Public Service Corp. & Subs.	30,000
	1,206,000

STEAM

Municipal and Other Public Plants	
Brownsville, Texas	7,500
Coffeyville, Kansas	10,000
Columbia, Missouri	7,500
Consumers Public Power District, Nebraska	5,000
Crawfordsville, Indiana	4,500
Fairbury, Nebraska	4,000
Fremont, Nebraska	4,600
Holyoke, Massachusetts	5,000
Kansas City, Kansas	30,000
Los Angeles, California	4,000
Moorehead, Minnesota	3,000
New Ulm, Minnesota	6,000
Norwalk, Ohio	3,000
Provo City, Utah	5,000
Richmond, Indiana	15,000
Rochester, Minnesota	7,500
Rocky Mount, North Carolina	15,000
Springfield, Illinois	20,000
	156,600

HYDRO

Private Companies	
Idaho Power Co.	16,500
Municipal and Other Public Plants	
Holyoke, Massachusetts	600
Idaho Falls, Idaho	1,500
Provo City, Utah	1,000
Rochester, Minnesota	1,500
Sturgis, Michigan	1,200
Tacoma, Washington	25,000
Tennessee Valley Authority	32,000
	82,800

INTERNAL COMBUSTION

Private Companies

Arizona Edison Co.	1,100
Idaho Power Co.	300
Louisiana Public Utilities Co., Inc.	1,000
Northern States Power Co. & Subs. (Minn.)	1,520
Otter Tail Power Co.	500
Sioux City Gas & Electric Co.—Iowa P. S. Co. System	3,231
Southeastern Indiana Power Co.	2,160
Utah Power & Light Co.	350
	10,161

Municipal and Other Public Plants

Buffton, Indiana	1,600
Brady, Texas	1,500
Bryan, Texas	1,000
Consumers Public Power District, Neb.	1,000
Denton, Texas	1,750
Lafayette, Louisiana	2,000
Opelousas, Louisiana	1,400
	10,250

Kind of Power	Private Companies	Municipal and Federal	Total
Steam	1,206,000	156,600	1,362,600
Hydro	16,500	62,800	79,300
Int. Comb	10,161	10,250	20,411
Totals	1,232,661	229,650	1,462,311

Generating Capacity to Be Added in 1947 and Later

STEAM

Private Companies	Kw. (Nameplate)
Boston Edison Co.	100,000
Central Illinois Electric & Gas Co.	24,000
Central Illinois Public Service Co.	50,000
Central Louisiana Electric Co.	15,000
Central Power & Light Co.	30,000
Cincinnati Gas & Electric Co. & Union Light Ht. & Pr. Co.	65,000
Connecticut Light & Power Co.	45,000
Consolidated Edison Co. of N. Y. & System Cos.	220,000
Delaware Power & Light Co. & Subs.	15,000
Duke Power Co.	60,000
El Paso Electric Co.	25,000
Florida Power Corp.	25,000
Hartford Electric Light Co.	35,000
Illinois Power Co.	120,000
Kansas City Power & Light Co.	35,000
Kentucky Utilities Co.	25,000
Long Island Lighting System	35,000
Louisiana Power & Light Co.	35,000
Louisville Gas & Electric Co.	50,000
Madison Gas & Electric Co.	30,000
Maine Public Service Co.	5,000
Mississippi Power Co.	22,250
Mississippi Power & Light Co.	30,000
Monongahela Power Co.	50,000
New Mexico Power Co.	3,000
New Orleans Public Service Inc.	30,000
New York State Electric & Gas Corp.	25,000
Northern States Power Co. (Wisc.)	12,500
Northwestern Public Service Co.	7,500
Otter Tail Power Co.	7,500
Pacific Gas & Electric Co.	75,000
Patchogue Electric Light Co.	4,000
Pennsylvania Electric Co.	30,000
Pennsylvania Power & Light Co.	150,000
Philadelphia Power & Light Co. & Subs.	162,000
Potomac Edison Co. & Subs.	30,000
Potomac Electric Power Co.	50,000
Public Service Co. of Colorado	47,500
Public Service Electric & Gas Co. of N. J.	100,000
Southern California Edison Co., Ltd.	50,000
Southern Colorado Power Co.	10,000
Southwestern Gas & Electric Co.	20,000
Southwesterrn Public Service Co.	45,000
Texas Electric Service Co.	40,000
Union Electric Co. of Missouri	80,000
Virginia Electric Power Co.	60,000
Wisconsin Electric Power Co.	80,000
	2,300,750

Municipal and Other Public Plants

Chicago, Illinois	10,000
Columbus, Ohio	12,500
Detroit, Michigan	40,000
Fort Wayne, Indiana	15,000
Glendale, California	20,000
Hagerstown, Maryland	5,000
Idaho Falls, Idaho	2,500
Jonesboro, Arkansas	3,000
Lakelannd, Florida	10,000
Lansing, Michigan	25,000
Los Angeles, California	69,000
Manetowac, Wisconsin	10,000
McPherson, Kansas	7,500
Owatonna, Minnesota	3,500
Pasadena, California	35,000
Rochester, Minnesota	7,500
Valley City, North Dakota	4,000
Vineland, New Jersey	7,500
	287,000

HYDRO

Private Companies

California Oregon Power Co.	25,000
Central Maine Power Co.	7,000
Citizens Maine Power Co.	1,500
New England Power System Cos.	35,000
Southern California Edison Co., Ltd.	50,000
	118,500

Municipal and Other Public Plants

Bureau of Reclamation	393,000
Seattle, Washington	180,000
	573,000

INTERNAL COMBUSTION

Private Companies

Otter Tail Power Co.	1,500

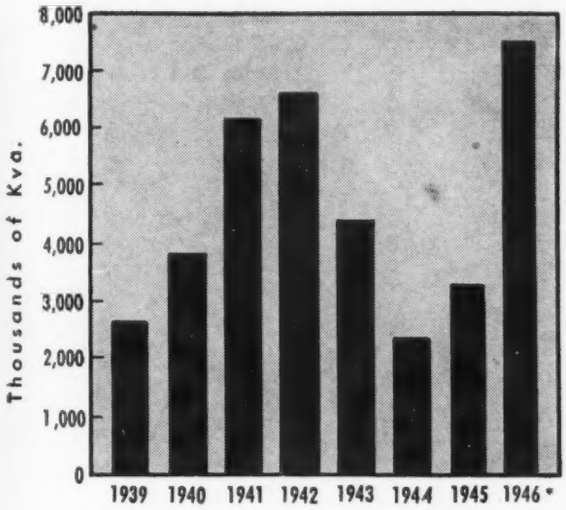
Municipal and Other Public Plants

Bryan, Texas	500
Grand Haven, Michigan	2,700
Hudson, Massachusetts	4,000
	7,200

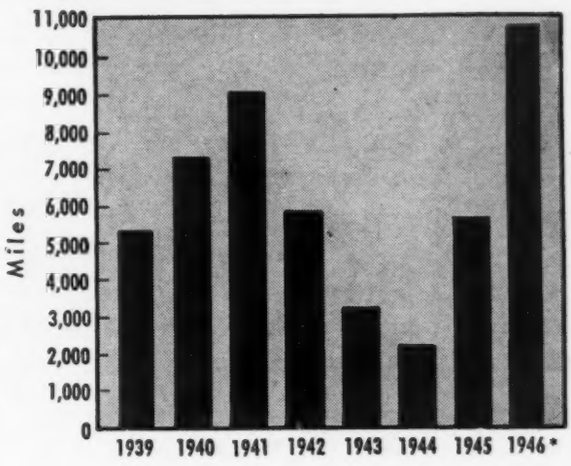
Kind of Power	Private Companies	Municipal and Federal	Total
Steam	2,300,750	287,000	2,587,750
Hydro	118,500	573,000	691,500
Int. Comb	1,500	7,200	8,700
Totals	2,420,750	867,200	3,287,950

TRANSMISSION and SUBSTATIONS

New Substation Capacity



New Transmission Lines



There will be over three times as much substation construction (measured in total kva.) completed in 1946 and considerably more even in kva. initiated than was installed in 1944. Substations completed in 1945 are a third more than in 1944.

The amount of substation capacity to be finished or begun in 1946 is just about double the very sizable 1942 activity when the nation was all out for war-production capacity.

Transmission line mileage in 1945 practically equalled the building in 1942 and exceeded the combined activities of 1943 and 1944. To be finished or initiated in 1946 will be a mileage three times as great as in 1942 or in 1943-1944.

Construction of Substations

(In Thousands of Kva.)

Region	1942	1943	1944	1945*	1946†	1946‡
New England	65	208	22	193	447	258
Middle Atlantic	597	460	221	199	742	1,241
East North Central	1,802	1,067	390	398	1,809	764
West North Central	833	443	72	207	780	367
South Atlantic	797	340	223	727	924	721
East South Central	1,293	868	377	518	627	511
West South Central	390	277	165	266	463	432
Mountain	67	139	18	215	467	147
Pacific	746	579	923	554	1,233	1,137
United States	6,590	4,381	2,411	3,277	7,492	5,578

Source: "Electrical World" Surveys. * Estimated. † Estimated to be finished. ‡ Estimated to be started.

Construction of Transmission

(In Miles — 11 Kv. and Up)

Region	1942	1943	1944	1945*	1946†	1946‡
New England	131	43	34	74	329	247
Middle Atlantic	618	232	149	290	720	700
East North Central	914	467	218	677	1,489	978
West North Central	645	308	178	1,628	2,681	934
South Atlantic	960	800	378	357	963	647
East South Central	698	206	355	335	655	488
West South Central	846	550	389	921	1,434	694
Mountain	335	321	70	406	1,102	564
Pacific	742	366	413	980	1,490	1,225
United States	5,889	3,293	2,214	5,668	10,883	6,477

Source: "Electrical World" Surveys. * Estimated. † Estimated to be finished. ‡ Estimated to be started.

57,382 miles in 1946

RURAL LINES

Mileage of rural lines of private utilities to be finished in 1946 will double the 1945 activity and be over 12 times the 1942 volume. In addition, there will be started a mileage of new lines which will in itself exceed the mileage completed in 1945.

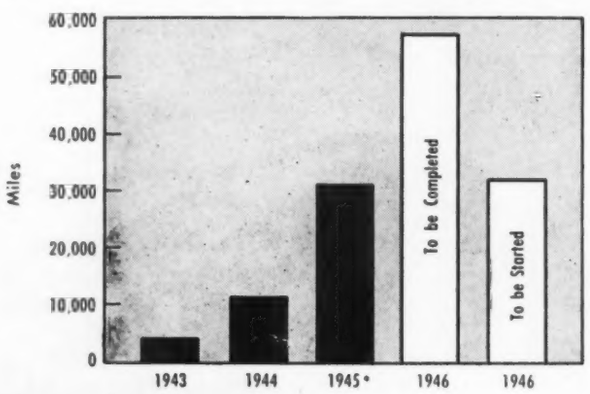
Expenditures in 1945 totalled $46,000,000 and the amount budgeted or estimated for 1946 is $80,000,000—three times the actual expenditure in 1944.

Utilities built nearly 31,000 miles in 1945; they built only 11,000 in 1944 and 4,000 in 1943. The amount actually built in 1945 exceeded by 22 percent the mileage projected a year ago.

If all the cost of lines to be finished in 1946 is included and none of the cost of the lines to be started, the apparent cost per mile is practically $1,400. The average cost of the lines built in 1945 was $1,485 per mile. Costs per mile ranged from $1,135 in New England to $2,170 in the Pacific States in the reported 1945 construction.

Largest absolute increase in mileage to be completed in 1946 is in New England; the South Atlantic, West North Central and West South Central regions are next.

Largest absolute increase in mileage to be completed or started will be the more than 10,000 miles to be added in the South Atlantic region.

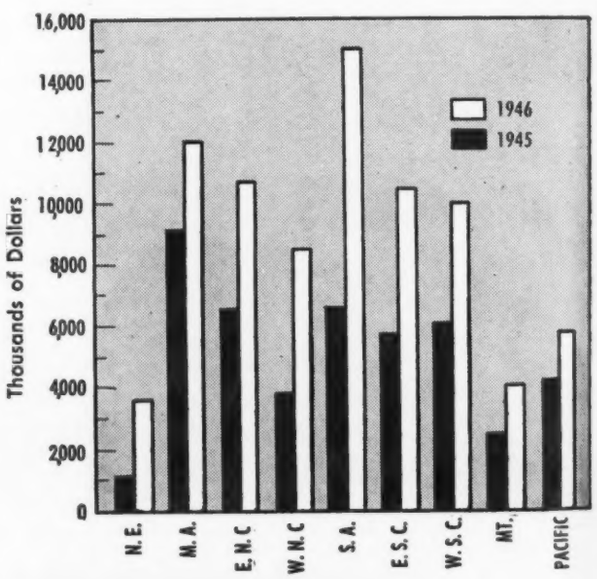


Miles of Rural Line Extensions

Regions	1942	1943	1944	1945	1946*	1946†
New England	150	72	196	957	2,800	932
Middle Atlantic	163	642	3,160	4,876	6,000	3,867
East North Central	638	1,073	2,065	5,475	9,500	4,193
West North Central	484	614	1,724	2,744	5,970	4,354
South Atlantic	906	321	473	4,563	10,526	5,420
East South Central	222	98	301	3,894	7,429	3,906
West South Central	592	490	1,992	4,376	8,975	6,218
Mountain	501	106	180	2,075	3,182	1,860
Pacific	1,004	546	842	1,440	3,000	1,480
United States	4,660	3,962	10,933	30,900	57,382	32,230

* Estimated construction to be completed in 1946.
† Estimated construction to be started in 1946.

As reported to "Electrical World." Not Including REA



Rural Line Construction Expenditures

(In Thousands of Dollars)

Regions	1944	1945	1946*
New England	446	1,084	3,625
Middle Atlantic	8,441	9,187	12,025
E. N. Central	5,078	6,550	10,700
W. N. Central	3,632	3,900	8,475
South Atlantic	1,785	6,600	15,103
E. S. Central	1,058	5,805	10,496
W. S. Central	1,973	6,087	10,050
Mountain	1,200	2,503	4,173
Pacific	3,237	4,212	5,860
United States	26,840	45,928	80,507

* Estimated.

As Reported to "Electrical World." Not Including REA

$232,039,000

MAINTENANCE

For maintenance of the electric systems over all the utilities spent in 1945 an amount 22 percent larger than they expended in 1944. In 1946 they plan to spend an even larger amount. Each of these two years reflects an outlay for upkeep of facilities that passes the $200,000,000 mark.

Not since the late '20s has any such amount been spent or budgeted for keeping the facilities in prime condition. The present and prospective outlays are practically double the amounts spent for maintenance in 1937-1939.

Shortage of manpower and difficulty in getting appropriate materials were the reasons why the $268,741,000 budgeted for 1945 shrank in actual expenditure to an extent of 18 percent.

Allocation of the maintenance dollars over an eight-year period shows that almost a third goes to the fuel generating plants and practically a half goes to distribution. Transmission gets one-tenth the total of funds spent for maintenance and hydro plants get one-twentieth.

Likelihood is that the amount budgeted for 1946 is conservative —having had to pare the 1945 outlay because of shortage of men and materials, there is reluctance to put down a figure that might also have to be pared.

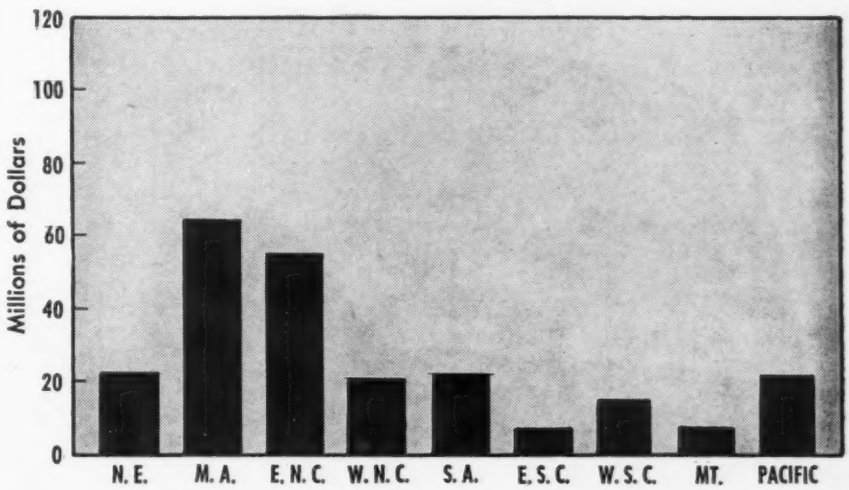
Nation-wide average of maintenance expense is $4.43 per kilowatt of generating capacity.

Maintenance Expenditures, 1946

(Thousands of Dollars)

Regions	1945	1946
New England	20,320	21,830
Middle Atlantic	64,700	64,150
E. N. Central	53,000	56,000
W. N. Central	17,080	20,185
South Atlantic	23,075	21,116
E. S. Central	6,800	6,615
W. S. Central	12,575	14,461
Mountain	5,650	6,712
Pacific	18,575	20,970
United States	221,775	232,039

As Reported to "Electrical World"
* Estimated.



Maintenance Expenditures Privately Owned Class A and B Electric Utilities in The United States (In Thousands of Dollars)

Production Expenses	1937	1938	1939	1940	1941	1942	1943	1944	Total	Percent
Steam Power	32,628	31,511	33,240	36,222	40,397	44,775	53,258	72,825	344,856	31.8
Hydraulic Power	5,524	6,192	5,985	5,995	6,369	6,152	7,955	10,583	54,755	5.2
Int. Comb. Eng. Power	723	622	659	731	702	759	809	1,020	6,025	0.6
Transmission	13,038	11,689	10,487	11,298	12,215	13,456	14,921	16,151	103,255	9.7
Distribution	62,292	62,604	62,027	63,789	65,446	66,108	69,624	76,700	528,590	49.4
General Properties	3,485	3,452	4,101	4,110	4,091	4,023	4,473	5,243	32,978	3.3
Total	117,690	116,070	116,499	122,145	129,220	135,273	151,040	182,522	1,070,459	100.0

Source: Federal Power Commission.

4,439 kw.-hr. per kw. of capacity

STATION ECONOMICS

Up to V-J day the weekly kilowatt-hour output followed the 1944 pattern very closely. After V-J day the output sagged sharply and leveled off at 10 percent less by late October.

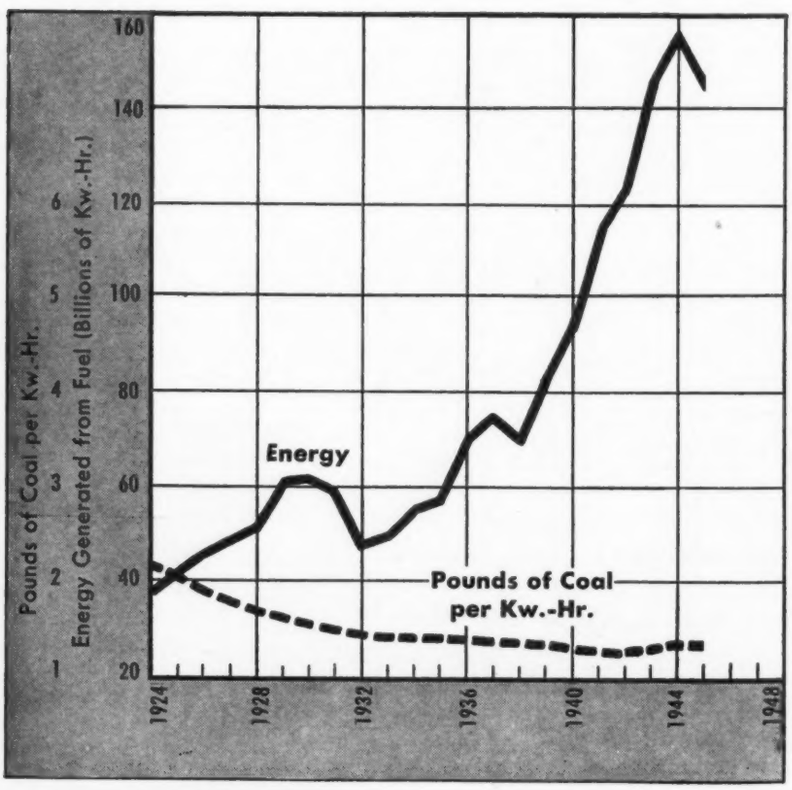
Those two assertions characterize 1945 electrically and help explain some of the indexes of system economics. The second-half dip can be charged with practically all the 3.6 percent less generated output.

While the generation activity was decreasing these 3.6 percent, the installed capacity was increasing 1.4 percent. As a consequence the hours use of each kilowatt (kilowatt-hours output of each average kilowatt) decreased from 4,630 in 1944 to 4,439 in 1945, a shrinkage of 5 percent.

Curtailed use of fuel-power generation was much greater than the average—11 percent, in fact. The reason was that, despite the lessened hours use of each kilowatt of hydro and fuel capacity, average hydro was worked up to 5,437 hours.

Hydro thus was used more assiduously than in any of the last 15 years except 1943. Less coal, oil and gas were used in 1945 than in 1944 in fuel burning generating plants.

Six percent less coal, 7 percent less fuel oil and 6.5 percent less gas were burned, first because load was down and second because it was a good hydro year. Nevertheless, coal used was double what it was in 1935; fuel oil double



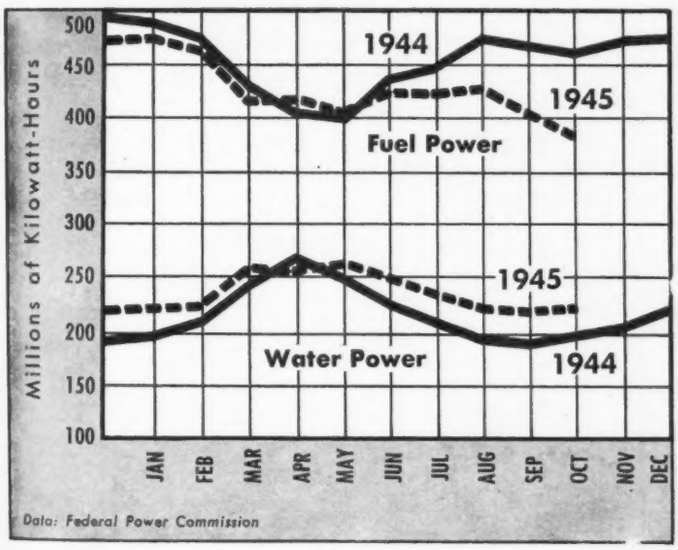
Output from Fuel and Fuel Used

Output, Capacity, Average Use

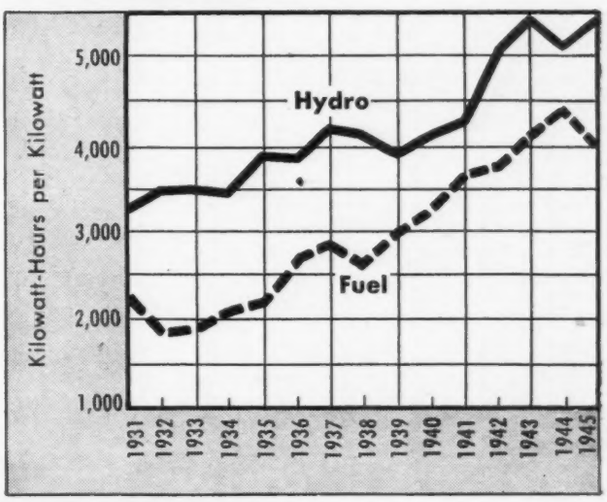
Year	Energy Generated (Millions of Kw.-Hr.)			Generating Capacity at end of year (Thousands of Kw.)			Output per Kw. of Ave. Cap. (Kw.-Hr.)		
	Fuel	Water	Total	Fuel	Water	Total	Fuel	Water	Total
1932.....	49,055	33,322	82,377	26,408	9,583	35,991	1,875	3,502	2,309
1933.....	50,678	34,058	84,736	26,507	9,736	36,243	1,915	3,526	2,346
1934.....	57,093	33,713	90,806	26,049	9,742	35,791	2,173	3,462	2,521
1935.....	59,430	39,034	98,464	26,279	9,795	36,074	2,271	3,996	2,740
1936.....	72,665	39,516	112,181	26,128	10,436	36,564	2,773	3,906	3,089
1937.....	77,348	44,489	121,837	26,558	10,577	37,135	2,936	4,234	3,306
1938.....	71,847	44,834	116,681	27,976	11,066	39,042	2,635	4,143	3,063
1939.....	86,314	44,022	130,336	28,903	11,415	40,318	3,035	3,916	3,285
1940.....	97,232	47,753	144,985	29,964	11,675	41,639	3,303	4,137	3,538
1941.....	116,908	51,262	168,170	31,828	12,261	44,092	3,784	4,283	3,923
1942.....	125,002	64,179	189,181	33,381	13,025	46,407	3,834	5,076	4,181
1943.....	147,027	73,943	220,970	35,237	14,068	49,305	4,285	5,458	4,617
1944.....	156,628	74,021	230,645	34,603	14,586	49,189	4,526	5,109	4,630
1945*.....	142,217	80,150	222,367	35,017	11,884	49,901	4,023	5,437	4,439

Source: Federal Power Commission. * Energy generated estimated for full year; generating capacity to November 1.

Average Daily Electricity Production



Average Use of Capacity



what it was in 1933 and gas double what it was in 1936.

Plant efficiency—expressed in nation-wide average of pounds of coal per kilowatt-hour—stayed at the 1944 figure of 1.33.

The years 1942 and 1943 had established a new low of 1.31 but neither presented the problem of inferior coal, switches in sources of supply and in adequate labor that marked 1944 and 1945, particularly the latter.

Of the fuel burned in utility power plants in 1945 over 20 percent was oil and gas. The respective coal equivalents of these two fuels were 5.67 and 14.4 million tons, figured on the bases of 3.42 bbl. of oil and 23,200 cu. ft. of gas equal to a ton of coal of fuel value of 11,600 B.t.u. per pound.

Output from Fuel and Fuel Used

Year	Energy Generated from Fuel † (Millions of Kw.-Hr.)	Fuel Consumed				
		Coal (Millions of Tons)	Oil (Millions of Bbl.)	Gas (Billions of Cu. Ft.)	†† Coal Equiv. (Millions of Tons)	Pounds of Coal per Kw.-Hr.†
1932..	48,931	30.30	7.97	107.84	36.70	1.50
1933..	50,546	30.58	9.95	102.73	37.15	1.47
1935..	59,176	34.16	11.38	125.24	43.20	1.46
1936..	72,188	42.03	14.12	156.08	51.99	1.44
1937..	76,883	44.77	14.14	171.27	55.14	1.43
1938..	71,525	40.21	13.08	170.69	50.56	1.41
1939..	85,800	46.22	17.42	191.13	59.51	1.39
1940..	96,609	53.40	16.77	183.16	65.14	1.35
1941..	116,167	64.76	20.25	205.16	77.99	1.34
1942..	124,401	68.42	15.28	238.74	81.44	1.31
1943..	146,200	79.67	18.09	301.09	95.70	1.31
1944..	156,328	82.31	20.87	359.77	103.92	1.33
1945*.	146,413	77.03	19.42	336.04	97.20	1.33

Source: Federal Power Commission. * Twelve months ended October 31.
† Output by use of wood not included. †† Coal plus oil plus gas.

GOVERNMENT POWER

Status of Federal and State Power Development—Existing and Contemplated

***DATA FOR THIS COMPILATION** were obtained from official sources. All capacity is hydro except as indicated by "F" to denote fuel power. "B.R." stands for Bureau of Reclamation, "C.E." for Corps of Engineers, U. S. Army, and "T.V.A." for Tennessee Valley Authority. Other agency initials are expanded in notes in the table.*

Project or Plant	Kw. In Operation	Kw. In Construction	Kw. Authorized or approved	Kw. Under Study	Kw. Ultimate	Agency
ALABAMA						
Fort Payne	850F				850	TVA
Guntersville	72,900		24,300		97,200	TVA
Wheeler	129,600		64,800		259,200	TVA
Wilson Dam	335,200		50,400		436,000	TVA
Wilson Steam	64,000F				64,000	TVA
Alabama-Coosa			250,000		250,000*	C.E.
State Totals	602,550		389,500		1,107,250	
ARIZONA						
Davis Dam		225,000			225,000	B.R.
Bridge Canyon				650,000	650,000	B.R.
Kanab Creek				1,250,000	1,250,000	B.R.
Marble Canyon				22,000	22,000	B.R.
Buttes				5,800	5,800	B.R.
Horseshoe				10,000	10,000	B.R.
Boulder*	1,034,800				1,322,300	B.R.
Alamo			4,500		4,500†	C.E.
State Totals	1,034,800	225,000	4,500	1,937,800	3,489,600	
ARKANSAS						
Norfolk	35,000				140,000	C.E.
Blakely Mountain			38,000		57,000	C.E.
Bull Shoals			126,000		336,000	C.E.
Narrows			17,000		30,000	C.E.
Table Rock			84,000		168,000	C.E.
Greers Ferry					78,000	C.E.
State Totals	35,000		265,000		809,000	
CALIFORNIA						
Shasta	154,000	225,000			379,000	B.R.
Keswick		75,000			75,000	B.R.
Delta					240,000	B.R.
Delta †				510,000F	510,000F	B.R.
Pine Flat			45,000	45,000	45,000	B.R.
North Fork Kings River				101,500	101,500	B.R.
Hot Springs				3,500	3,500	B.R.
New Melones*				48,000	48,000	B.R.
Tulloch				20,000	20,000	B.R.
Folsom				60,000	60,000	B.R.& C.E.
Folsom-Canal				18,000	18,000	B.R.
Monticello				25,000	25,000	B.R.
Sloughhouse				16,000	16,000	B.R.
Garden Bar				4,000	4,000	B.R.
Bidwell Bar				169,000	169,000	B.R. & C.E.
Nashville				18,000	18,000	B.R.
Bullards Bar				60,000	60,000	B.R. & C.E.
Coloma				40,000	40,000	B.R.
Yuma	1,600				5,600	B.R.
Trinity River				170,000	170,000	B.R.
New Colgate				50,000	50,000	B.R.
Table Mountain			45,000		45,000	C.E.
Table Mountain				200,000	200,000	B.R.
Narrows			69,500†		69,500†	C.E.
Parker Dam	120,000				120,000	B.R.
New Don Pedro				60,000	60,000	B.R.
Kennedy				35,000	35,000	B.R.
Oroville				40,000	40,000	B.R.
Elbow				20,000	20,000	B.R.
Nashville				18,000	18,000	B.R. & C.E.
Big Bend				200,000	200,000	B.R. & C.E.
State Totals	274,000	300,000	159,500	1,931,000	2,865,100	
COLORADO						
Colorado— Big Thompson	21,600		130,400		152,000	B.R.
Blue River— S. Platte				350,000	350,000	B.R.
Gunnison— Arkansas				700,000	700,000	B.R.
Narrows— S. Plate				15,000	15,000	B.R.
Grand Valley	3,000				3,000	B.R.
Echo Park				120,000	120,000	B.R.
Upper Rio Grande				1,800	1,800	B.R.
Clear Creek Falls				1,600	1,600	B.R.
Santa Maria Inlet				8,000	8,000	B.R.
Santa Maria Outlet				50,000	50,000	B.R.
Rio Grande Gerrard				25,000	25,000	B.R.
Counsellor				5,800	5,800	B.R.
Notch Trail				2,800	2,800	B.R.
State Totals	24,600		130,400	1,280,000	1,435,000	
GEORGIA						
Allatoona			72,000		108,000	C.E.
Fort Benning					7,800	C.E.
Clarks Hill			223,000		223,000	C.E.
Hartwell			177,500		177,500	C.E.
Goat Island			99,400		99,400	C.E.
Middleton			42,800		42,800	C.E.
Chattooga			68,500		68,500	C.E.
Tallow-Hill			43,100		43,100	C.E.
Anthony Shoals			22,400		22,400	C.E.
Newry-Old Pickens			37,200		37,200	C.E.
Roswell			42,500		42,500	C.E.
Cedar Creek			45,200		45,200	C.E.
Lanier			56,400		56,400	C.E.
Woodbuey No. 2			23,900		23,900	C.E.
Potato Creek			16,900		16,900	C.E.
Umchumpkee			20,400		20,400	C.E.
Blue Ridge	20,000				20,000	TVA
State Totals	20,000		991,200		1,055,000	
IDAHO						
Anderson— Ranch Dam		27,000			40,500	B.R.
Palisades			30,000		30,000	B.R.
Mountain Home				165,000	165,000	B.R.
Cabinet Gorge			132,000		132,000	B.R.
Challis				5,000	5,000	B.R.
Lower Lenhi				2,500	2,500	B.R.
Oneida				15,000	15,000	B.R.
Boise	1,500				1,500	B.R.
Black Canyon	8,000				8,000	B.R.
Minodoka	13,400				13,400	B.R.
Bliss	13,400			158,000	158,000	B.R.
Enaville				20,000	20,000	B.R.
Kooskia				259,000	259,000	B.R.
Arrowrock				13,000	13,000	B.R.
Hell's Canyon					495,000	B.R.
Wolf Creek					425,000	B.R.
Nez Perce					175,000	B.R.
Asotin					175,000	B.R.
State Totals	22,900	27,000	162,000	637,500	2,132,900	
KENTUCKY						
Wolf Creek			135,000		278,000	C.E.
Jessamine Creek			13,900		13,900	C.E.
Bonneville			7,300		7,300	C.E.
Bowling Green	7,250F				7,250	TVA
Kentucky	96,000	64,000			160,000	TVA
Hopkinsville	4,300F				4,300	TVA
Mayfield	5,000F				5,000	TVA
Murray	200F				200	TVA
State Totals	112,750	64,000	156,200		475,950	
MICHIGAN						
Sault Ste. Marie*			14,000		45,000	C.E.
State Totals			14,000		45,000	
MISSISSIPPI						
Corinth	1,800F				1,800	TVA
Tupelo	3,500F				3,500	TVA
State Totals	5,300				5,300	
MISSOURI						
Table Rock			84,000		168,000	C.E.
Narrows			17,000		25,500	C.E.
State Totals			101,000		193,500	
MONTANA						
Canyon Ferry			35,000		35,000	B.R.
Yellowtail			75,000		75,000	B.R.
Hungry Horse			142,000		142,000	B.R.
Kalispell Lyons			23,500		23,500	B.R.
Portage			20,000		20,000	B.R.

Not determined. Taken at authorized capacity.

*Includes Nevada side.
†Taken at authorized figure.*

*Authorized by Congress for construction by Corps of Engineers.
†Not determined. Figure used has been published previously.
‡Supplemental fuel power plants to firm up B.R. hydro capacity, locations undetermined.*

Replacement and enlargement of small existing plant.

Project or Plant	Kw. In Operation	Kw. In Construction	Kw. Authorized or approved	Kw. Under Study	Kw. Ultimate	Agency
Fort Peck	35,000	.....	50,000	.....	105,000	C.E.
Flathead No. 2	.....	.....	.....	.....	46,500	B.R.
Flathead No. 3	.....	.....	.....	.....	23,500	B.R.
Flathead No. 4	.....	.....	.....	.....	80,000	B.R.
Canyon Ferry	.....	.....	24,000	.....	36,000	B.R.
Donlan	.....	.....	.....	.....	45,000	B.R.
Fish Creek	.....	.....	.....	.....	10,000	B.R.
Rock Island Gorge	.....	.....	.....	.....	56,000	B.R.
State Totals	35,000	.....	369,500	.....	697,500	
NEBRASKA						
27 Plants	10,337	.....	.....	.....	10,337	CPPD*
45 Plants	27,537F	.....	.....	.....	27,537	CPPD*
8 Plants	130,698	.....	.....	.....	130,698	NPPS†
8 Plants	54,225F	.....	.....	.....	54,225	NPPS†
Bostwick	.....	.....	2,000	.....	2,000	B.R.
No. Platte-Kearney	.....	.....	25,000	.....	25,000	B.R.
Grand Island	.....	.....	50,000	.....	50,000	B.R.
State Totals	222,797	.....	77,000	.....	299,797	

*Consumers Public Power District.
†Nebraska Public Power System.

NEVADA						
Upper Truckee	.....	.....	.....	11,000	11,000	B.R.
Washoe Lake	.....	.....	.....	5,000	5,000	B.R.
State Totals	.....	.....	.....	16,000	16,000	
NEW MEXICO						
Middle Rio Grande						
El Vado	.....	.....	.....	15,000	15,000	B.R.
Abiquiu	.....	.....	.....	22,500	22,500	B.R.
Chamita	.....	.....	.....	25,000	25,000	B.R.
Chama No. 1	.....	.....	.....	15,000	15,000	B.R.
Chama No. 2	.....	.....	.....	15,000	15,000	B.R.
Chama No. 3	.....	.....	.....	15,000	15,000	B.R.
Hooker	.....	.....	.....	3,000	3,000	B.R.
Elephant Butte	24,300	.....	.....	.....	24,300	B.R.
San Juan-Chama						
Willow Creek No. 1	.....	.....	.....	5,700	5,700	B.R.
Willow Creek No. 2	.....	.....	.....	3,300	3,300	B.R.
Willow Creek No. 3	.....	.....	.....	8,000	8,000	B.R.
Willow Creek No. 4	.....	.....	.....	11,500	11,500	B.R.
Chiflo	.....	.....	.....	81,000	81,000	B.R.
Caballo	.....	.....	.....	10,000	10,000	B.R.
State Totals	24,300	.....	.....	230,000	254,300	
NEW YORK						
Mount Morris	.....	.....	5,000	.....	5,000	C.E.
St. Lawrence	.....	.....	.....	.....	820,600*	N.Y.S.P.A.†
State Totals	.....	.....	5,000	.....	825,600	

*Same capacity projected for Canadian side of river.
†New York State Power Authority.

NORTH CAROLINA						
Fontana	135,000	.....	67,500	.....	202,500	TVA
Hiwassee Dam	57,600	.....	57,600	.....	115,200	TVA
State Totals	192,600	.....	125,100	.....	317,700	
NORTH DAKOTA						
Missouri Souris						
N. Dak. Div.	.....	.....	139,000	.....	139,000	B.R.
Garrison	.....	.....	80,000	.....	320,000	C.E.
Heart Butte	.....	.....	.....	.....	500	B.R.
State Totals	.....	.....	219,000	.....	459,500	
OKLAHOMA						
Fort Gibson	.....	.....	49,200	.....	73,800	C.E.
Markham Ferry	.....	.....	45,000	.....	72,000	C.E.
Pensacola	64,000	.....	.....	.....	64,000	S.W.P.A.*
State Totals	64,000	.....	94,200	.....	209,800	

*Southwestern Power Administration.

OREGON						
Lower Grande Ronde	.....	.....	.....	3,900	3,900	B.R.
Cove	.....	1,500	.....	.....	1,500	B.R.
Detroit	.....	.....	.....	.....	84,000*	C.E.
Lookout Point	.....	.....	.....	.....	54,400*	C.E.
Quartz Creek	.....	.....	.....	.....	128,000*	C.E.
Umatilla	.....	.....	966,000	.....	966,000	C.E.
Snake River	.....	.....	512,000†	.....	1,071,000†	C.E.
Bonneville	518,400	.....	.....	.....	518,400	C.E.
Catherine Creek	.....	.....	.....	.....	800	B.R.
Little Indian Creek	.....	.....	.....	.....	2,700	B.R.
Mason	.....	.....	.....	.....	3,000	B.R.
Lewis Creek	.....	.....	.....	19,500	19,500	B.R.
Reese Creek	.....	.....	.....	6,500	6,500	B.R.
State Totals	518,400	1,500	1,478,000	29,900	2,859,700	

*Best figures obtainable, not final.
†Preliminary estimates.

SOUTH CAROLINA						
Conway	1,800F	.....	.....	.....	1,800	SCPSA*
Pinopolis	130,125	.....	.....	1,800	131,925	SCPSA*
Buzzard Roost	27,000	.....	.....	.....	27,000	GSEPC*
State Totals	158,925	.....	.....	1,800	160,725	

*South Carolina Public Service Authority.
†Greenwood County Electric Power Commission.

SOUTH DAKOTA						
Angostura	.....	.....	1,500	.....	1,500	B.R.
Oahe-James River	.....	.....	141,500	.....	141,500	B.R.
Moreau River	.....	.....	600	.....	600	B.R.
Oahe	.....	.....	80,000	.....	320,000	C.E.
State Totals	.....	.....	223,600	.....	463,600	
TENNESSEE						
Center Hill	.....	90,000	.....	.....	135,000	C.E.
Dale Hollow	.....	36,000	.....	.....	54,000	C.E.
Appalachia	75,000	.....	.....	.....	75,000	TVA
Ocoee No. 1	18,000	.....	.....	.....	18,000	TVA
Parksville	13,000F	.....	.....	.....	13,000	TVA
Chickamauga	81,000	.....	27,000	.....	108,000	TVA
Columbia	800	.....	.....	.....	800	TVA
Wilbuy	3,700	.....	.....	.....	3,700	TVA
Estill Springs	800	.....	.....	.....	800	TVA
Greenville	10,640	.....	.....	.....	10,640	TVA
Hales Bar	40,000F	.....	.....	.....	40,000	TVA
Hales Bar	51,100	.....	.....	.....	51,100	TVA
Cherokee	60,000	.....	30,000	.....	120,000	TVA
Watauga	8,500F	.....	.....	.....	8,500	TVA
Fort Loudon	64,000	.....	64,000	.....	128,000	TVA
McMinnville	250F	.....	.....	.....	250	TVA
Nashville	48,000F	.....	.....	.....	48,000	TVA
Norris	100,800	.....	.....	.....	100,800	TVA
Pickwick	144,000	.....	36,000	.....	216,000	TVA
Ocoee No. 2, 3	46,900	.....	.....	.....	46,900	TVA
Great Falls	31,860	.....	.....	.....	31,860	TVA
Douglas	60,000	.....	30,000	.....	120,000	TVA
Shelbyville	432F	.....	.....	.....	432	TVA
Watts Bar	240,000F	.....	.....	.....	240,000	TVA
Watts Bar	150,000	.....	.....	.....	150,000	TVA
Watauga	.....	.....	.....	.....	60,000	TVA
South Holston	.....	.....	.....	.....	50,000	TVA
State Totals	1,248,782	126,000	187,000	.....	1,830,782	
TEXAS						
Denison	35,000	.....	.....	.....	175,000	C.E.
Whitney	.....	.....	28,000	.....	28,000	C.E.
Rockland Dam	.....	.....	16,700	.....	16,700	C.E.
McGee Bend	.....	.....	29,300	.....	29,300	C.E.
Power Dam A	.....	.....	4,180	.....	4,180	C.E.
Power Dam B	.....	.....	4,800	.....	4,800	C.E.
Canyon Dam	.....	.....	1,200	.....	7,000	C.E.
Austin	15,000	.....	.....	.....	15,000	L.C.R.A.*
Buckanan	25,000	.....	.....	.....	37,500	L.C.R.A.*
Inks	12,500	.....	.....	.....	12,500	L.C.R.A.*
Mansfield	75,000	.....	.....	.....	75,000	L.C.R.A.*
Breckinridge	.....	.....	.....	3,600	3,600	B.R.
Seymour	.....	.....	.....	1,500	1,500	B.R.
Winchell	.....	.....	.....	11,000	11,000	C.E. & B.R.
Marble Falls	.....	.....	.....	56,000	56,000	C.E. & B.R.
Rockland Dam	.....	.....	13,060	.....	13,060	B.R.
McGee Bend	.....	.....	23,220	.....	23,220	B.R.
Canyon Dam	.....	.....	1,200	2,700	3,900	B.R.
State Totals	162,500	.....	121,660	74,800	517,260	

*Lower Colorado River Authority.

UTAH						
Prove R	.....	.....	8,600	.....	8,600	B.R.
Hurricane	.....	.....	.....	4,600	4,600	B.R.
Strawberry Extension	.....	.....	.....	15,000	15,000	B.R.
Echo-Fark	.....	.....	.....	120,000	120,000	B.R.
Dewey	.....	.....	.....	140,000	140,000	B.R.
State Totals	.....	.....	8,600	279,600	288,200	
VIRGINIA						
Buggs Island	.....	.....	85,500	.....	114,000	C.E.
Philpott No. 4	.....	.....	9,000	.....	9,000	C.E.
Gaston	.....	.....	54,000	.....	54,000	C.E.
Roanoke Rapids	.....	.....	58,800	.....	58,800	C.E.
Smith Mountain	.....	.....	33,000	.....	33,000	C.E.
Leesville	.....	.....	16,000	.....	16,000	C.E.
Taber	.....	.....	10,000	.....	10,000	C.E.
Melrose	.....	.....	34,500	.....	34,500	C.E.
Randolph	.....	.....	24,000	.....	24,000	C.E.
Stuart	.....	.....	9,000	.....	9,000	C.E.
Schoolfield	.....	.....	24,000	.....	24,000	C.E.
State Totals	.....	.....	357,800	.....	386,300	
WASHINGTON						
Columbia Basin	818,000	324,000	.....	.....	1,974,000	B.R.
Yakima	2,400	.....	10,000	.....	14,400	B.R.
Foster Creek	.....	.....	.....	1,024,000	1,024,000	B.R. & C.E.
Priest Rapids	.....	.....	.....	.....	720,000	B.R.& C.E.
Chelan	.....	.....	.....	.....	475,000	B.R.& C.E.
Rocky Reach	.....	.....	.....	.....	380,000	B.R.& C.E.
Z-Canyon	.....	.....	.....	.....	400,000	B.R.& C.E.
State Totals	820,400	324,000	10,000	1,024,000	4,987,400	
WEST VIRGINIA						
Bluestone	.....	60,000	.....	.....	180,000	C.E.
State Totals	.....	60,000	.....	.....	180,000	
WYOMING						
Kortes	.....	.....	36,000	.....	36,000	B.R.
Big Horn-Boysen	.....	.....	15,000	.....	15,000	B.R.
Hunter Mountain	.....	.....	12,000	.....	12,000	B.R.
Glendo	.....	.....	15,000	.....	15,000	B.R.
Thief Creek	.....	.....	60,000	.....	60,000	B.R.
Sunlight	.....	.....	20,000	.....	20,000	B.R.
Bald Ridge	.....	.....	30,000	.....	30,000	B.R.
Kane	.....	.....	30,000	.....	30,000	B.R.
Tongue River	.....	.....	25,000	.....	25,000	B.R.
Elk Horn	.....	.....	.....	1,000	1,000	B.R.
Kendrick	32,400	.....	.....	.....	32,400	B.R.
Riverton	1,600	.....	.....	.....	1,600	B.R.
Shoshone	5,600	.....	.....	.....	5,600	B.R.
Guernsey	4,800	.....	.....	.....	4,800	B.R.
Lingle	1,400	.....	.....	.....	1,400	B.R.
Hoback	.....	.....	.....	.....	40,000	B.R.
Canyon	.....	.....	.....	.....	70,000	B.R.
State Totals	45,800	.....	243,000	1,000	399,800	
Grand Totals	5,627,004	1,127,500	5,933,660	7,443,400	27,941,964	

highest refunding year

FINANCIAL

In no previous year were refunding operations of electric utilities so great as in 1945. No higher figure than 1945's $1,322,253,000 appears in the record published by "Electrical World," which goes back to 1923, and it is not likely that any year before that approaches such a level.

The record shows refunding of over a billion dollars in only three other years, 1935, 1936, and 1944, and in only one of them, 1936, does the figure come within $100,000,000 of the 1945 amount.

The reason for the record level of refunding in the past year shows in the average rates of yield of mortgage bonds and preferred stocks in 1945 in comparison with those of years just past. Bond yields decreased from 3.23 percent in 1943 to 2.92 in 1944 and then to 2.77 in 1945. For preferred stocks the yields were 4.44, 4.09, and 3.86 percent in the three years.

Security issues during the year were 70 in number, 20 more than in 1944. Making up this increase were 14 more issues of bonds, one of which is offset by one less of debentures, plus 7 more issues of common stock by which 1945 is higher than the one and only in 1944. Perhaps there is cause for mild rejoicing in 1945's eight issues of common amounting to $29,266,162 as against 1944's one issue of only $1,081,000.

New capital entering the business is still insignificant in comparison with the size of the industry although it is over twice as much as in 1944 and over four times 1943.

In 1941, institutional investors took 41 percent of the bonds, debentures, etc., offered by utilities then. The record, which goes back to 1934, does not show a higher proportion in any other year. In the two years just past the ratio was around 10 percent, about 1 percent less in 1945 than in 1944.

New Utility Financing Totals

No. of Issues	Range of Yield	Amount of Issues
Mortgage Bonds (Av. yield 2.77%)		
6	2.63–2.68	$281,746,000
11	2.70–2.75	315,189,000
6	2.76–2.87	211,425,000
8	2.90–2.98	154,700,000
4	3.00–3.05	112,500,000
3	3.50–3.93	2,901,000
9	.....	127,793,000
47		$1,206,254,000
Preferred Stock (Av. yield 3.86%)		
4	3.63–3.79	$59,011,300
3	3.82–3.95	17,726,000
3	4.02–4.29	17,000,000
2	.....	4,265,000
12		$98,002,300
Common Stock		
8	.....	$29,266,162
Debentures		
2	.....	$28,000,000
Notes		
1	.....	$400,000
Total Financing	.....	$1,361,922,462
Refunding	.....	1,322,252,711
New Capital	.....	39,669,751

Security Sales by Classes

(In Thousands of Dollars)

Year	Bonds, Debentures, etc., to		Stocks, Common and Pfd.	Total Financing	Distribution of Security Sales		
	Public Investors	Institutional Investors			New Capital	Refunding	Total Issues
1931	1,090,584	Included	417,658	1,508,242	424,163	758,741	1,182,904
1932	404,840	in	65,417	470,257	165,728	239,112	404,840
1933	53,725	Col. 1	2,523	56,248	6,813	46,913	53,725
1934	131,175		.....	131,175	2,431	128,744	131,175
1935	957,042	110,629	8,229	1,075,900	26,496	1,049,404	1,075,900
1936	1,122,800	156,881	52,259	1,331,940	59,727	1,272,213	1,331,940
1937	522,613	37,604	86,095	646,312	81,984	563,699	645,682
1938	750,549	192,762	20,694	964,005	123,056	840,949	964,005
1939	620,205	252,625	123,517	996,347	16,219	980,128	996,347
1940	660,716	188,976	139,767	989,459	92,376	897,083	989,459
1941	368,712	255,912	116,208	740,832	97,065	643,767	740,832
1942	226,800	99,688	29,766	356,254	92,666	263,588	356,254
1943	329,300	26,850	14,912	371,062	9,921	361,141	371,062
1944	851,743	103,950	62,535	1,018,228	15,587	1,002,641	1,018,228
1945	1,113,603	121,051	127,268	1,361,922	39,699	1,322,253	1,361,922

summary statement of

OUTSTANDING FACTS

	1938	1939	1940	1941	1942	1943	1944	1945*
FIXED CAPITAL ($1,000,000)	12,348	12,388	12,658	12,964	13,082	13,143	13,050	.....
Securities issued [1] ($1,000)	964,005	996,347	989,459	740,832	356,254	371,062	1,018,228	1,361,923
New capital	123,056	16,219	92,376	97,065	92,666	9,920	15,587	39,669
Refunding	840,949	980,128	897,083	643,767	263,588	361,141	1,002,641	1,322,253
REVENUE [2] ($1,000)								
From ult. consumers	2,156,580	2,289,583	2,440,218	2,665,057	2,885,843	3,077,643	3,276,751	3,334,000
Rural	38,928	45,484	49,273	64,396	75,027	76,617	82,842	90,000
Residential	802,532	843,158	895,951	938,229	990,185	1,029,260	1,097,726	1,167,000
Small light and power	632,091	660,683	689,253	725,117	767,279	776,228	817,356	835,000
Large power and light	518,694	572,659	631,428	758,083	828,318	961,642	1,043,392	1,014,000
Other consumers	164,334	167,597	173,752	179,233	195,034	233,996	235,436	228,000
EXPENDITURES ($1,000)								
Capital [3]	482,000	430,000	596,580	654,148	522,200	305,904	340,284	408,929
PRIVATE COMPANIES ($1,000)								
Operating revenue	2,018,000	2,148,000	2,277,000	2,475,000	2,611,000	2,807,000	2,955,000	3,000,000
Operating expenses	762,000	798,000	863,000	950,000	1,011,000	1,117,000	1,225,000	1,242,000
Taxes	323,000	352,000	404,000	521,000	630,000	688,000	677,000	683,000
Salaries and wages	333,000	340,000	355,000	376,000	381,000	371,000	388,000	400,000
OUTPUT [4] (1,000,000 kw.-hr.)								
Generated	116,681	130,336	144,985	168,170	189,181	220,728	230,645	222,367
From steam	70,727	85,007	95,675	115,276	123,356	145,045	154,828	140,417
From water power	44,834	44,021	47,753	51,262	64,179	73,922	14,021	80,150
From internal combustion	1,120	1,307	1,557	1,632	1,646	1,761	1,800	1,800
CAPACITY [4] (1,000 kw.)								
Generator ratings	39,042	40,318	41,639	44,092	46,407	49,305	50,278	49,901[5]
Steam	27,203	28,047	29,019	30,823	32,332	34,178	34,609	33,941[5]
Hydro	11,066	11,415	11,675	12,264	13,025	14,067	14,604	14,884[5]
Internal combustion	773	856	945	1,005	1,049	1,060	1,064	1,076[5]
FUEL CONSUMPTION [4]								
Coal (1,000 short tons)	40,212	46,223	53,398	64,760	68,420	79,665	82,310	74,000
Oil (1,000 bbl.)	13,077	17,423	16,722	20,250	15,280	18,085	20,810	19,000
Gas (billion cu. ft.)	171	191	183	205	239	301	360	333
ENERGY SALES [2] (1,000,000 kw.-hr.)								
Ult. consumers	93,371	105,768	118,643	140,060	159,408	185,889	198,161	194,000
Rural	1,577	1,881	1,991	2,352	2,890	2,996	3,373	3,650
Residential	19,371	21,084	23,318	25,124	26,937	28,621	31,266	34,100
Small light and power	19,137	20,722	22,373	24,628	27,234	29,071	29,837	30,250
Large power and light	43,140	51,108	59,557	76,060	88,378	105,778	115,187	108,450
Other	10,505	10,972	11,405	11,896	13,968	19,423	18,498	17,550
CUSTOMERS [2] (1,000)								
Total number	28,064	29,105	30,191	31,607	32,210	32,396	33,048	33,900
Rural	526	634	686	987	1,096	1,088	1,144	1,220
Residential	23,112	23,965	24,952	26,025	26,620	26,872	27,371	28,000
Small light and power	4,127	4,215	4,260	4,300	4,219	4,168	4,263	4,380
Large power and light	192	184	178	173	150	147	153	182
Other	107	106	115	122	125	121	118	118
People in homes served (1,000)	96,915	100,855	97,424	102,695	104,882	105,000	107	110,000
Per cent of total civil population	74.9	77.3	74.0	78.0	77.4	77.3	80.0	80.0—
EMPLOYEES, total	270,000	269,000	265,000	270,000	.....	226,800	220,000	225,000

* Estimated, generally on ten months' operations. [1] Includes warrants and rights. [2] Revised figures beginning with 1937 conform to Uniform System of Accounts. [3] Excludes Federal Projects. [4] Includes other electric, in addition to light and power. [5] As of November 1.

peace-time production under way

MANUFACTURING

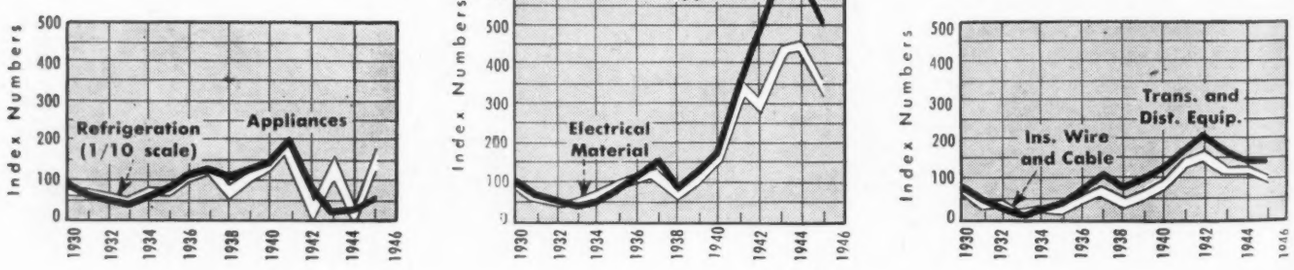
Downward trend for electrical machinery in all categories of reporting continues, reflecting termination of government war contracts. Department of Commerce indexes for shipments, new orders, and inventories are the lowest yet reached.

Refrigeration production index is on the way up, as is also that for appliances. Production in these two classifications is expected to continue to rise in 1946, and may approach 1940 and 1941 levels.

Trend for industrial apparatus and electrical material is downward. The high points for these two groups were reached in 1943 and 1944, the war's peak years in production. Transmission and distribution equipment production is expected to increase slightly.

E.M.I. production declined sharply, reflecting termination of war contracts for production of both electrical and non-electrical goods. The same trend is reflected in the movement of F.R.B. production. But sales of electricity are holding up despite these

Manufacturers' Sales (Index: 1925 = 100)



Major Branches of Electrical Manufacturing Industry — Index Numbers 1925 = 100

	Manufacturers' Sales	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945*
1. Appliances	100 = $140,000,000	92	121	136	109	128	151	212	73	12	16	60
2. Refrigeration	100 = 16,000,000	844	1,131	1,360	769	1,100	1,331	1,800	264	158	25	177
3. Electrical material	100 = 38,000,000	93	116	131	83	116	149	253	318	447	453	362
4. Industrial apparatus	100 = 132,000,000	83	118	161	97	127	177	317	465	638	633	505
5. Trans. and dist. equip	100 = 167,000,000	50	83	124	90	104	124	189	213	167	141	142
6. Ins. wire and cable	100 = 110,000,000	46	69	98	60	71	87	157	155	135	121	110

Source: NEMA * Estimated.

1. APPLIANCES include domestic kitchen and table appliances, electric ranges, electric water heaters, electric vacuum cleaners, electric washing machines, electric fans and food service equipment.
2. HOUSEHOLD REFRIGERATION includes complete units, parts and cabinets. Commercial refrigeration equipment and air conditioning equipment are excluded.
3. ELECTRICAL MATERIAL includes carbon, electrical porcelain, laminated phenolic products, manufactured electrical mica and vulcanized fiber. Molded insulation is excluded.
4. INDUSTRIAL APPARATUS includes electric welding equipment and wire, industrial controls, industrial heating equipment and motors and generators (excluding all generators except motor-generator sets). Electric furnaces and electric tools are excluded.
5. TRANSMISSION AND DISTRIBUTION EQUIPMENT includes switchgear, high-voltage insulators, power and distribution transformers, lightning arresters, pole line hardware and earth anchors, panelboards and distribution boards, small air circuit breakers and watt-hour and demand meters.
6. INSULATED WIRE AND CABLE for light and power includes only the following types: weatherproof wire, paper-insulated power cable, varnished cambric cable, rubber-sheathed cord and cable and rubber-covered building wire.

All indices based upon U. S. Census of Manufacturers data and NEMA statistical department data corrected where possible to represent the entire industry.

The Industry and Related Factors

Index Numbers 1925 = 100

	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945*
1. E. M. I. production	85	119	137	97	123	154	276	415	522	553	430
2. E. M. I. employment	94	106	128	77	84	106	155	†	†	†	†
3. F. R. B. production	96	113	124	97	120	137	178	219	263	258	231
4. Sales of electricity	155	180	199	187	212	238	281	319	372	396	395
5. Population	111	112	113	113	114	115	116	117	119	120	122
6. Electrical goods orders	77	109	133	90	124	205	336	555	†	†	†

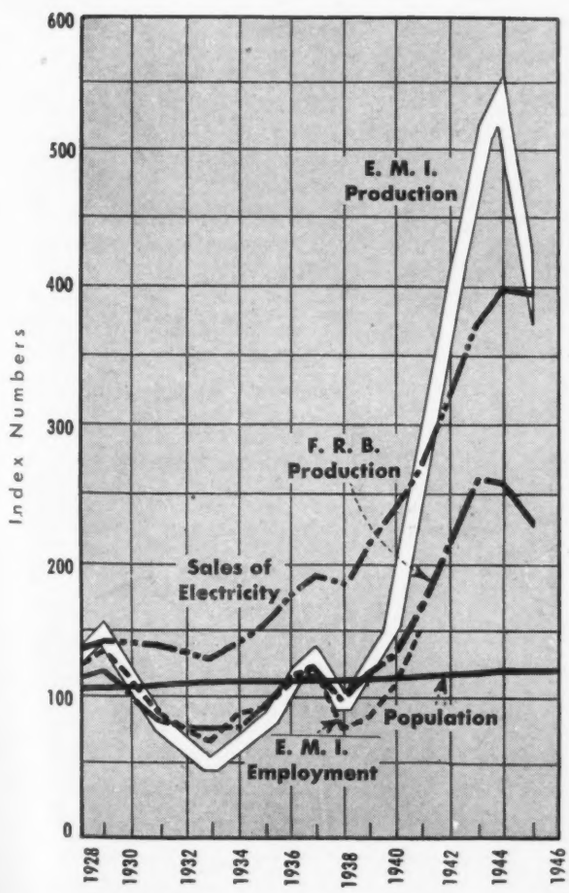
Source: NEMA *Estimated. †Not available.

1. E.M.I. PRODUCTION based on U. S. Census of Manufacturers and data compiled by NEMA statistical department. In addition to products shown in electrical machinery apparatus and supplies schedule of the Census there are included electric refrigeration, radio apparatus and supplies, steam turbines for electrical drive, electrical porcelain, glass insulators and electric washing machines. Indices for the war years reflect production of non-electrical as well as electrical goods.
2. E.M.I. EMPLOYMENT based on labor series of National Industrial Conference Board, but adjusted to 1925 = 100. This series represents the electrical manufacturing industry including radio.
3. F.R.B. PRODUCTION based on the Federal Reserve Board's revised index for the manufacturing industry and adjusted to 1925 = 100. (Includes all revisions made by Federal Reserve Board up to Dec. 15, 1943.)
4. ELECTRIC POWER SALES index figures based upon Edison Electric Institute data.
5. POPULATION based upon the annual mid-year estimates of the U. S. Bureau of the Census.
6. NEW ORDERS booked — electrical goods — based on the quarterly reports of the U. S. Bureau of the Census.

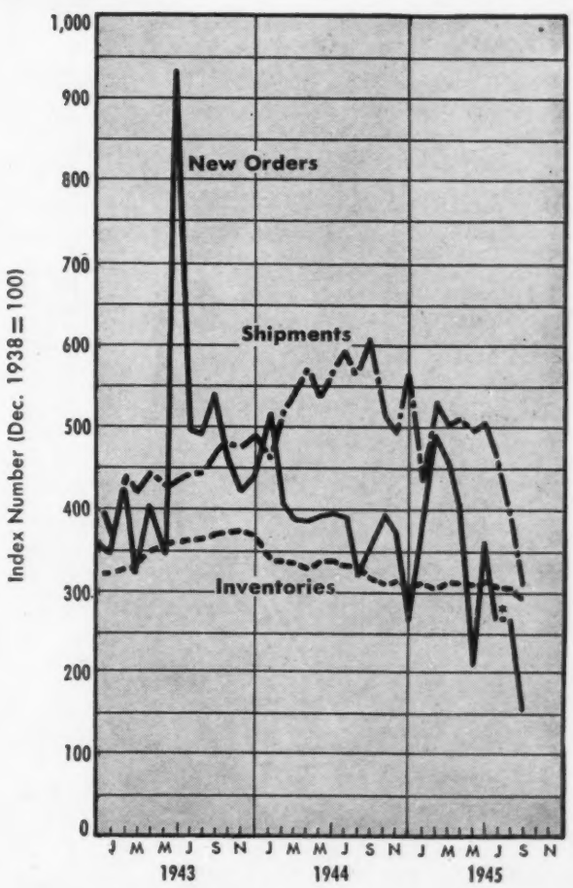
drops in the two production indexes.

Index numbers for the war years should be used with some reservation because for those years no complete industry data from government sources were available for checking them. No Census of Manufacturers has been taken since 1939 and information on electrical products collected by the War Production Board had not been received when the indexes were calculated.

Electrical Manufacturing and Related Factors



Electrical Machinery



Data: Department of Commerce

* Value of orders cancelled in August exceeded orders received in that month.

REA operations ratios change

In 1945 REA cooperatives are estimated in national terms to have:

Had a total system input of 2,601 million kw.-hr.

Which cost them 8.64 mills per kw.-hr. consumed.

Sold 1,525 kw.-hr. per customer

At 3.45 cents per kw.-hr.

For an annual bill of $52.60.

And had an operating ratio of 57.2 percent after taxes.

These ratios show a less favorable operation picture than do the figures for 1944. The reason is that the Ark-La Electric Cooperative, which supplied large amounts of energy to the DPC aluminum plant at Lake Catherine, Ark., operated for only nine months in 1945.

Funds allotted per mile of distribution line now amount to $1,313. Adding generation and transmission raises the figure to $1,447.

Revising these estimates in the ratio of funds advanced to funds allotted (69.2 percent), which brings them closer to actual costs, makes them $910 and $1,000, respectively.

Figure for average customers per mile of line is 3.07.

Although the proportion of delinquent payments to funds advanced is extremely small, less than 0.1 percent, examination of the trend of delinquencies (more than 30 days overdue) is rising on a much steeper curve than are funds advanced. This is particularly true in regard to interest payments, in which delinquencies estimated for 1945 are more than five times what they were in 1941, while funds advanced have increased only 40 percent.

Over against this trend is the over-all condition that principal repaid has consistently remained substantially in excess of principal due over the five years of record publication of REA statistics in "Electrical World." In 1945 the accumulated excess repayment is estimated at 55 percent.

Item	Calendar Year 1943	Calendar Year 1944	Calendar Year 1945 [1]
Cumulative Year-End Data			
Total Funds Allotted	$473,741,747	$517,699,947	$668,950,000
Distribution Lines	$419,820,140	$456,335,090	$595,200,000
Generation and Transmission	$42,995,144	$49,662,394	$61,450,000
Consumer Facilities	$10,926,463	$11,702,463	$12,300,000
Funds Advanced	$378,496,489	$406,370,722	$463,700,000
Systems in Operation	811	826	842
Miles of Line in Operation	390,058	410,471	453,900
Consumers Connected	1,087,801	1,216,798	1,391,100
Systems Generating Power	65	65	74
Generating Plants—Kw. Capacity	73,200	76,500	94,600
Annual Data			
Energy Generated—Kw. Hr.	199,228,028	213,461,544	251,000,000
Energy Purchased—Kw. Hr.	1,828,132,383	2,105,332,282	2,350,000,000
Total System Input	2,027,360,411	2,318,793,826	2,601,000,000
Energy Sold—Kw. Hr.	1,679,381,428	1,925,734,206	2,123,000,000
Operating Revenues	$55,587,614	$64,042,574	$73,340,000
Cost of Power [2]	$16,728,209	$19,622,451	$22,470,000
Salaries and Wages	$7,291,457	$8,243,802	[3] $19,380,000
General Expenses	$5,114,339	$5,793,966	
Insurance, Taxes and Misc	$2,647,332	$2,980,614	
Total Operating Expenses	$31,781,337	$36,640,833	$41,850,000
Net Non-Operating Income	$417,760	$560,492	$530,000
Interest Due and Payable	$8,128,335	$8,304,171	[3] $7,910,000
Interest Accumulated Not Due	$1,104,476	$446,107	
Net Income Before Depreciation	$14,654,317	$18,996,377	$24,110,000
Payments to Government Cumulative Data			
Interest Due	$29,836,009	$40,930,604	$49,550,000
Interest Paid	$29,638,004	$40,634,176	$49,070,000
Principal Due	$16,150,385	$27,365,109	$36,070,000
Principal Paid	$31,302,737	$45,331,068	$55,950,000
Overdue Amounts—More than 30 days	$215,576	$373,959	$572,000
a. Interest	$157,470	$271,149	$420,000
b. Principal	$58,106	$102,810	$152,000
Advance Payments of Principal	$15,229,508	$18,085,514	$20,050,000

Source of Data: Monthly operating reports of REA Borrowers.

[1] Based on ten (10) months actual data and one (1) to three (3) months estimated. Figures on borrowers' operations based on all reports received from borrowers; other data based on records of the Rural Electrification Administration.

[2] Cost of power includes cost of purchased power and prime costs involved in the production and transmission of generated energy.

[3] Expense breakdown shown for 1943 and 1944 not available in 1945 because of revision in the reporting practice of REA borrowers. Consolidated expense reflects the sum of bracketed items. The change in presentation does not affect the comparability of total expense or net income for the three years shown. Estimated operating expenses for 1945 according to the new classification are:

Cost of Power	$22,470,000
Distribution Expenses—Operations	4,430,000
Distribution Expenses—Maintenance	3,020,000
Consumers Accounting and Collecting	2,520,000
All Other Operating Expenses	9,410,000
Total Operating Expenses	$41,850,000

chronology of 1945

JANUARY

Nebraska Power Co. sale to non-profit corporation completed. Sale price, $14,421,000.

Brownout order to save coal issued by War Mobilization Director James F. Byrnes.

Murray reintroduces MVA Bill in Senate.

Order U-9, forbidding use of electric energy for outdoor advertising, display, promotional, decorative and ornamental lighting, issued by WPB.

WMC rates utilities as critical industries in revised list of essential activities.

Bill to reestablish REA as independent agency introduced in Senate.

High taxes a factor in determining rates of an electric utility, Pennsylvania Public Utility Commission rules. Holds Pennsylvania Power & Light Co. rates are not in excess. Two complaints against rates charged by company dismissed.

President Roosevelt recommends that loan authorizations for REA for the fiscal year ending June 30, 1946, be increased from $25,000,000 to $150,000,000.

Roosevelt selects Aubrey Williams as Administrator of REA.

Brownout exemption given to chain of states ranging from Canada to Gulf of Mexico.

FEBRUARY

Omaha acts to end power controversy. Civic Committee on Power named to solve problems arising from sale of Nebraska Power Co.

Eastern financiers enter Northwest utility fight. Guy C. Myers, New York, offers to purchase Puget Sound Power & Light Co. for banking syndicate.

MARCH

Nebraska Supreme Court, ruling that City Council's resolution appointing the People's Power Commission under LB204 did not have to be submitted to a vote of the people, clears way for Omaha to take over Nebraska Power Co.

Budget Bureau planners suggest moving FPC, SEC, FTC, ICC to Commerce Department. President could make transfer under the Second War Powers Act.

U. S. Supreme Court decision favors state regulation. Rules in Connecticut Light & Power case that ownership of electric power facilities used for local distribution does not subject company to FPC jurisdiction.

Senate rejects Aubrey Williams as Rural Electrification Administrator.

APRIL

Aluminum production cut would hit Bonneville Power Administration program, Dr. Paul Raver testified before Senate Small Business Committee. States half of BPA revenue comes from aluminum plants. Testimony indicates BPA depends on industry to sell post-war power. Shipshaw project under Congressional investigation.

Maine brownout lifted.

MAY

V-E Day results in amendment of Order U-1 by OWU and revocation of all supplementary orders. WPB also revokes orders as contract terminations and cutbacks grow. Brownout abandoned. Travel restrictions remain.

David E. Lilienthal reappointed to TVA.

REA celebrates tenth anniversary and frees funds making up a $100,000,000 construction backlog. Urges 900 cooperative borrowers to begin work on "the biggest power line construction job in history."

OWU approves utility construction projects, following cancellation of discounts on turbo-generators and switchgear by General Electric, Westinghouse and Allis-Chalmers.

Omaha compromise signed by Governor Griswold.

President Truman names Wickard as Administrator of REA.

JUNE

Construction restrictions lifted under Amended U-1.

Quebec Hydro-Electric Commission passes under complete control of the government of the province.

Ohio Supreme Court rules Cleveland Transit System liable for real and personal property taxes. Decision may affect all other municipally owned utilities in Ohio.

Claude R. Wickard approved as Administrator of REA.

Nelson L. Smith of New Hampshire sworn in for five-year term on FPC.

JULY

War Mobilization Director Fred Vinson, in third report of his office to Congress, reveals Administration's post-war plans. Lists nine points for action after V-J Day to raise American standard of living.

Representative Boren of Oklahoma tells House of attempts to convert public utility industry to tax-free but fake public ownership. Involves Howard L. Aller, president of American Power & Light Co., who answers the charges, defending Omaha transaction. Boren named chairman of subcommittee of House Interstate and Foreign Commerce Committee to investigate loopholes in the Public Utility Holding Company Act.

Electric light and power companies formulate policy on river developments by the United States.

OWU Director Edward Falck takes steps to fold up organization. Cut in personnel ordered. Power Section work nears end.

Bureau of Reclamation opens fight for power markets in northern California. Announces execution of contract with City of Roseville. Other municipal systems, served by Pacific Gas & Electric Co., prospects for Shasta energy.

Navy gas turbine demonstrated at Elliott Co. plant at Jeannette, Pa.

AUGUST

Utilities expansion plan in first year following V-E Day put at $700,000,000 in U. S. Commerce Department survey.

V-J Day ends war in Pacific. Important role played by electric equipment in atomic bomb revealed.

OWU announced final revocation of Order U-1 as of September 30. Agency to be disbanded. Electric utilities to be freed of all war-time controls except those on inventories which will come under WPB. L-94, establishing system interconnections, revoked. Falck resigns. Convention curbs eased.

Puget Sound Power & Light Co. offered $115,000,000 by 13 public utility districts in western Washington.

SEPTEMBER

Richard Sachse, California Railroad Commission, and Harrington Wimberly, Oklahoma newspaper publisher, named to FPC by President Truman. Basil Manly, chairman, resigns to become president of the Atlanta Gas Light Co.

Hurricane strikes southern Florida. Florida Power & Light Co. hit hardest. South Carolina reports some loss.

Pacific Gas & Electric Co. fights to retain territory. Asks commission approval for nine five-year contracts with municipalities, embodying a new rate schedule. Signs contracts with seven others.

OCTOBER

President Truman dedicates TVA Kentucky Dam.

WPB ends work. Chairman J. A. Krug resigns. Agency replaced by Civilian Production Administration under John D. Small.

Congress starts work on tax-cutting plan. Program will aid electric utilities.

Lieut. Gen. Raymond A. Wheeler appointed Chief of Engineers, succeeding Lieut. Gen. Eugene Reybold.

NOVEMBER

Public power bloc questions scientists on future of atomic power at hearings before the Joint Senate subcommittees on war mobilization and commerce considering legislation to establish a National Research Foundation.

Court affirms Michigan Public Service Commission order, directing Detroit Edison Co. to rebate $10,450,000 to 1944 customers.

U. S. Supreme Court starts hearings on constitutionality of "death sentence" clause of the Public Utility Holding Act of 1935. Quorum of six justices finally found.

House appropriations committee, reporting the first deficiency appropriation bill, slashes funds for public power projects. Goes on record against construction of transmission lines to dispose of federal power.

National Reclamation Association opposes river authorities as sponsors of reclamation projects at annual convention in Denver.

DECEMBER

Cornelius W. DeForest, of Cincinnati, replaces Col. Walker L. Cisler, Detroit Edison Co., as United States chief in charge of German utilities under Allied Control Authority.

REA starts move back to Washington from St. Louis.

Leland Olds elected chairman of FPC.

MVA hearings extended.

House and Senate in conference committee settle differences on deficiency appropriation bill, after Upper Chamber had increased funds for many projects and bureaus formerly slashed by the House.

Rural electric cooperatives in Arkansas, Oklahoma and Missouri plan $220,000,000 superpower system.

The Year in Review

Electric utilities relieved of war-time controls—Office of War Utilities bows out—New REA administrator—PUD's attack Northwest utilities—"Death sentence" clause argued before Supreme Court

FRANK R. INNES, *Associate Editor, "Electrical World"*

OUTPUT OF ELECTRICITY exceeded 4.6 billion kw.-hr. in the week of January 13, 1945. Twice before, in the Decembers of 1944 and 1943, output had gone above the 4.6 level. After that maximum week the 1945 output curve went down to a low of 3.841 in November. Nevertheless, 1945's total output of 222 billion kw.-hr. was only about 4 percent under the 231 billion of 1944. Exceptionally good water supply made 1945 the record year in hydroelectric production with 80 billion kw.-hr., reducing fuel power generation considerably more than in proportion to the decrease in total output.

Concern in regard to fuel supply was felt early in the year and on February 1 a brownout was ordered. Within a week exceptions were granted to states whose electricity needs were largely supplied by hydro and by fuels other than coal. The Office of War Utilities protested a regulation of the Solid Fuels Administration that would reduce utility stock piles below safe supply. As result of the OWU contention, utilities were moved up to second place on the SFA priorities list. The brownout order was lifted with the German surrender but the shortage continued and was not greatly eased by the ending of the Japanese war in August.

Curtain for OWU

The Office of War Utilities set an admirable example for war-time agencies of government by the speed with which it shed its functions and took itself out of existence. First OWU made a promise and kept it that revocation of many and revision of other utility orders would come on V-E Day. Little remained after that date except restrictions on construction which were progressively lightened and finally removed as were all other remaining controls soon after the Japs surrendered. Then on September 30 OWU was disbanded officially.

Provision of the immense quantities of electrical equipment for production of the atomic bomb greatly complicated OWU's scheduling of utility requirements. That was the first impact of atomic fission on the electric utilities although not then known for what it was. Then when the bomb became public knowledge, atomic energy loomed up immediately as a possible power producer and had its to-be-expected extravagant day. One manifestation was the introduction in Congress of a bill for an Atomic Power Authority. More reasonable ideas soon prevailed, however, as testimony of scientists showed that practicable utilization of atom splitting for power production is still quite distant in the future.

Less spectacular, but more immediately useful technical advances were made during the year. Certain German air circuit breakers, rated 110 kv. and up, that performed excellently under severe conditions, were brought over and are being tested in this country. An important forward step in the prime mover art was made in the completion and testing of a 2,500-hp. gas turbine ordered by the Navy and to be used for ship propulsion. An experiment in transmission at potentials from 264,000 to 500,000 volts, started late in the year, will be closely watched as its results are made known. And the Journal of the American Medical Association published an "official" opinion that fluorescent lighting is not harmful to human vision.

Get Into Politics

Warnings that survival of business enterprise in electricity supply depends on much improved public relations again were heard during the year. A member of the Pennsylvania Public Utility Commission advised power company folks to get into politics and fight for their convictions. Following dissolution of the Council of Electric Operating Companies, there was formed the National Association of Electric Companies with headquarters in Washington and designed functionally along the lines of the American Association of Railroads.

Several tax decisions in states may be said to be not harmful to the power companies. The Texas supreme court held that a state river authority may not be taxed, nor can it make payments in lieu of taxes. Also in Texas REA cooperatives were ruled to be taxable. High taxes were recognized as a rate determinant in Pennsylvania. The Ohio supreme court decided that the Cleveland municipal transit system was liable for taxes.

Local controversy followed sale of Nebraska

Power Co. for transfer to public ownership and Rep. Lyle Boren rose in the Congress to term the deal "Swindle, Inc." The ubiquitous Guy C. Myers who engineered the Nebraska sale entered the bitter private-public ownership fight in the Northwest with an offer to buy Puget Sound Power & Light Co. for $115,000,000 for later resale to local public utility districts. He also was named a P.U.D. agent for similar proposal to Washington Water Power Co. In the state of Washington, legislation was passed strengthening the P.U.D.'s while in Oregon acquisitive powers of the P.U.D.'s were restricted. Although certain holdings of Washington Water Power were taken over by P.U.D.'s, the end of the year found both power companies still within the ranks of private enterprise. The Arizona Power Authority started action to take over major utilities in that state.

Not Too Good A Year

Soon after taking office, President Truman announced he would continue the power policy of his predecessor. But 1945 can not be said to have been a particularly good year for the government power advocates. A general bill for nine regional authorities was introduced but got nowhere. The Missouri Valley Authority proposal received short shrift in Senate Committees. Novelties appeared in bills for a Columbia Valley Authority, which provided for a large measure of local control, and for an Ohio V A containing no power provisions. Both MVA and CVA encountered opposition from local groups "weary and wary" of domination from Washington. Efforts to revive the St. Lawrence project foundered on the old question of treaty or no treaty with Canada. An ambitious Army plan for power development on the Potomac aroused such vociferous opposition that it was abandoned. Late in the year the deficiency appropriation bill was cut drastically in the House in respect of power projects. The Senate bill restored some of the cuts, but compromise of the bills in conference left power appropriations still below what was asked.

Money for REA

For the fiscal year 1946, REA will have some $300 million for construction, 100 from unexpended funds, 80 from the Agriculture Department appropriation bill and 120 from the deficiency appropriation bill. A bill to give REA $585 million for a three-year program died because a provision to make the agency independent of Agriculture was included. The question of independence was regarded as up to Mr. Truman, but he said nothing on it and the idea bogged down in Congress. The three-year program also met opposition not only from power companies but from municipal utilities and cooperatives. Early in the year Mr. Roosevelt nominated Aubrey Williams to succeed Harry Slattery as REA administrator. The Senate examined Mr. Williams, decided it did not like many of his ideas and rejected him. Next nominee was Claude Wickard, former Secretary of Agriculture, who was approved after some backing and filling.

State Commissions vs. FPC

Usurpation of authority continued to be charged against the Federal Power Commission. The Arkansas Power & Light Co. asked a U. S. District court to decide between orders on it issued by FPC and by the state public service commission. The Arkansas legislature endorsed action of the state commission against FPC. The chairman of the New York commission challenged FPC authority in attempting to assert jurisdiction over seven gas utilities. The Montana commission attacked FPC conduct in a rate case of the Montana Power Co. In Maryland the state commission rejected FPC's theory of original cost in favor of determination of fair value. Efforts of FPC to bring Connecticut Light & Power Co. into its jurisdiction as an interstate utility were stopped by a supreme court decision. To succeed Basil Manley, chairman, and John W. Scott, resigned, Harrington Wimberly, Oklahoma newspaper publisher, and Richard Sachse, member of the California Railroad Commission, were appointed to FPC. Leland Olds, chairman from 1940 to 1944, was reelected to that office.

Some Labor Difficulties

Constitutionality of the "death sentence" clause of the 1935 holding company act was finally argued before the Supreme Court in November. Likelihood of decision holding the provision unconstitutional was heavily discounted.

Nineteen hundred forty-five was not a bad year for the utilities as regards labor troubles. A strike by employees of the Lower Colorado River Authority, marked by some vandalism, resulted in a lockout of the strikers and employment of new workers. A four-day strike against Consumers Power Co. ended in a 13-cent increase in hourly wage rates.

His term expiring, David Lilienthal was reappointed to the TVA board and was confirmed despite opposition of Senators Tom Stewart and Kenneth McKellar that ordinarily would have disqualified him. TVA took over the East Tennessee Light and Power Co. in March.

Conversion difficulties greater than had been anticipated, increased costs bumping against ceiling prices, and generally unsettled labor conditions coming to a head in strikes, joined together to prevent electric appliance production reaching expected levels. Indications at the end of the year were that production in the first half of 1946 would be considerably less than had been predicted earlier.

Electrical Manufacturers Plan Market Expansion

Looking ahead to future markets, NEMA sections undertake extensive promotional activities in the appliance, lighting and other utilization equipment fields, tying in with local sales efforts

R. L. WHITE, *President, National Electrical Manufacturers Association*

DURING THE WAR YEARS a tremendous backlog of demand for electrical products accumulated. Now that the fighting is ended, the electric utilities and other industries, too, are starting or are about to start large programs of expansion. It would seem that electrical manufacturers have now and will have for some time plenty to do in supplying the waiting market. Nevertheless they are going ahead with extensive plans for market development.

All of the promotional activities of the National Electrical Manufacturers Association are being stepped up, including the Adequate Wiring Program, Farm Electrification, Street and Highway Lighting, Rural and Suburban Market Development, and also the activities of the appliance sections in their various fields.

Even before the war's end WPB had permitted some slight reconversion on a few of the electric appliances deemed most essential to the civilian economy. With the exception of flatirons, however, little real progress was made even on the limited programs when V-J Day came suddenly, followed by the wholesale withdrawal of wartime production curbs. Only then did real reconversion get under way and, considering the complexity of its products, the industry has made very creditable progress. Additionally, adequate supplies of raw materials must be provided, labor difficulties settled, and wage and price problems resolved.

Must Restore Distribution

Normal channels of distribution for consumer goods such as appliances, involving from 30,000 to 50,000 dealers throughout the country, must be reestablished and supplied on a fair and equitable basis. Extensive programs of retraining, sales promotion and advertising must also be carried out before the steady flow of goods can be resumed on a scale adequate to meet the pent-up demand.

Although no electric appliances were produced during the war except for essential uses, various appliance sections of the National Electrical Manufacturers Association engaged in limited activities designed primarily to pave the way for speedy resumption of production following V-J Day.

The educational program of the electric range and water heating sections, built around a new and authoritative text book on the electric range, is providing factual information on electric cooking equipment to thousands of home economics teachers in the nation's schools.

The builders' program reminds builders and architects of the tremendous public desire for electric servants, and stresses the importance of designing and building every post-war home with an adequate electric service and proper circuits so that electric cooking and water heating appliances may be readily and economically installed.

Tie in with Local Promotion

These sections are also developing and furnishing to the utilities plans for coordinated local activities with builders, architects, dealers and lending agencies. A program of rural and suburban market development largely supported by these sections is just now getting under way. To reach this market an activity is being set up which will be sponsored by the manufacturers at the national level, but largely carried on by the electric utilities at the local level.

The Household Refrigeration Section of NEMA, while not engaging as a group in the direct promotion of household refrigerators, has been very active in the home freezer field. Popular interest in food freezing and the storage of frozen food inspired by war-time developments is very great. Recently completed NEMA standards for the measurement and testing of home freezers have been of great benefit to the industry, particularly to those new manufacturers who are now for the first time producing refrigeration for household use.

During 1946 this section of NEMA will expand

its activity and is planning to issue factual information on the essential requirements for the preparation of foods for freezing and on the operation of the home freezer.

The electric fan, one of the oldest appliances, is being made the subject of group promotional and informational activity for the first time in 1946. The Electric Fan Section has embarked upon a program of information designed to develop public consciousness of the desirability and effectiveness of air in motion as an aid to comfortable living in the modern way.

Development of Farm Market

Surveys indicate that within a few years about $500 will be spent by the average newly connected farm customer for electric appliances and farm production equipment, while each currently served farm customer will spend an estimated $270 for additional appliances and equipment.

Both the farm electrification and the rural and suburban market development of NEMA are being substantially expanded in 1946 to reach this important field.

One of the most formidable barriers to more extensive development of appliance sales is the inadequacy of wiring installations in the majority of dwelling structures, wiring systems which are unable properly to serve the present or anticipated requirements of a public conscious of the values of electric service.

Adequate wiring, therefore, will be a keystone of the home modernization and improvement market, and is being intensively promoted by the National Adequate Wiring Bureau, with the cooperation of local bureaus, electrical leagues, utilities, and retail and wholesale outlets.

The headway being made in relighting streets and highways was much decreased during the war, but a sound program of education has been carried on by the Street Lighting Sections of NEMA. States, counties and cities are planning street and highway lighting programs which will total millions of dollars, California alone planning an expenditure of $80 million.

This educational program is being accelerated in 1946 and messages will be carried in magazine advertising, through direct-by-mail folders and monthly news letters sent to municipal officials and utility company executives. In addition a campaign of educational publicity has recently been inaugurated through the media of magazines, newspapers and radio.

The Industrial and Commercial Lighting Equipment Section of NEMA is also placing the accent on lighting with plans for the International Lighting Exposition to be held at the Hotel Stevens, Chicago, beginning April 25. The exhibits will be restricted to NEMA members making various types of lighting and accessory equipment and to certain non-member groups of makers of lighting sources and non-electrical accessories. Invitations to attend the Exposition will be extended to the electrical wholesalers, electrical contractors, sales and illuminating engineering departments of utilities, architects, consulting engineers, maintenance and plant engineers, and other groups.

R. L. White

Replacements after War Production

With the reconversion of industry to peace-time production, replacements of industrial equipment will have to be on a heavy scale after four years of unprecedented production for war. In this market the backlog of orders is already great and growth of it will continue for some months to come.

Apparatus sections of NEMA are active in the preparation of new and revised standards which, in 1946, will be extended into the international field.

The Public Information Program, initiated in 1944, is still growing so that it may adequately provide basic over-all information about the electrical manufacturing industry and what it does for America.

The year 1946 will indeed be an important one in the electrical manufacturing industry, and once wages, labor, manufacturing methods, material supplies, price policies, and other factors are established on a sound and workable basis, the industry will quickly get into stride.

Editorials

S. B. WILLIAMS, *Editor*

Electrical Strike Affects Others

ONE OF THE UNFORTUNATE RESULTS OF STRIKES is that the effects can not be limited to the disputants. Almost always others who have no part in making any of the decisions are injured in some manner. In the present strike, for instance, against the two largest electrical apparatus manufacturers, considerable harm can be done throughout the electric utility industry. Construction expenditures this year, as shown elsewhere in this issue, are planned at a near-record level. New generating capacity is needed both to take care of expected peaks as well as to build up the reserve necessary to a dependable service. Orders for turbines and generators are scheduled for production time in the manufacturers' shops. Any lengthy strike would throw this schedule off, with the result that utilities needing these units to handle certain peaks may have to make other arrangements.

Rural line construction already handicapped by material shortages will be further delayed. The same will be true if the strike is prolonged with respect to substation construction, for which a large program is projected, and all similar expansion and rehabilitation.

At the same time, the strike will delay the delivery of appliances affecting not only the public but the dealers who have made arrangements for handling them. Many of these dealers are returned veterans just starting in business. It isn't only the loss of appliance output of the closed factories but the lowered production of other manufacturers who depend upon these large companies for small motors and other parts.

Perhaps, however, at this particular time it is just as well that others than the immediate disputants are affected because this isn't so much a strike against certain companies as it is against a national situation. Here are companies that have made it their business to be progressive in creating good labor relations. They were picked out in this case not because their employees were sore or had any special grievances but simply because they were the leaders in an industry that was deeply intertwined in the fabric of American economy. Electrical manufacturing, along with steel, automobiles and meat, is a key industry. Moreover, in each of these key industries there are certain leaders of such size that any action directed against them would have pretty much the same effect as though directed at all the units of the industry. Whatever the outcome, it may be expected to be the pattern for collective bargaining in the rest of the industry.

An Alternative for Shallow Soil Driven Rod Distribution Grounds

SINCE DRIVEN RODS are a logical answer to the need for low resistance of distribution grounds, and they are not feasible where the soil is of shallow depth what is the alternative?

Why cannot distribution take a leaf from the book of transmission in this particular exigency? Transmission engineers would certainly consider a buried counterpoise. Distribution engineers, however, would be deterred even from thinking of the alternative because of the many situations where hand digging would be prohibitive and where the straight-away would be too short to justify a tractor-drawn cable-plow. Here is where a simple winch-tractioned portable plow would open up enough length and depth of trench between poles to afford a distribution counterpoise. It is recognized that there are plenty of places where the plow and the counterpoise could not be used, but most of them would be in the cities and the congested suburbs where other grounds are usually available anyhow.

No Tax Immunity to States in Business

WHILE no essentially new principle was laid down in the New York State Saratoga Water case this week by the United States Supreme Court, the decision, as was anticipated, will undoubtedly have a marked effect upon future acquisition of private power investment by local government units. No longer can a city, state or other normally tax-free agency go on the assumption that it can afford to pay considerably more than anyone else for private utility property because of tax immunity.

Both public and private power ownership advocates have awaited this decision with the feeling that it would go a long way toward settling the argument of whether normally tax-exempt bodies could withdraw from the government rolls property that had been paying taxes and whether it was right to discriminate in taxes between public and private business operation. While some of the concurring opinions were not willing to go all the way on the general subject, this decision left no doubt in the minds of the dissenters that the majority opinion would remove local government electric power operations from immunity.

The suggestion in one concurring opinion that Congress should definitely spell out a policy in this connection is hardly practical because of politics. Immediately that comes up, the central point will be lost in a long drawn out

argument on states' rights which will control any decision. It is much better to build up a background of judicial decision until there can be no question as to what is right.

It is fortunate that this subject of tax immunity can be thrashed out in cases where it can be argued on its merits rather than on ideological grounds. If a local government were to engage in the manufacture and sale of liquors, there would be no question about the federal authority to levy taxes thereon. It isn't difficult, then, to jump from hard to soft drinks. And when those soft drinks come from a natural resource and their bottling is but a part of a larger social program and are still taxable, the case is made for power.

It seems obvious in reading the decision that the Court must have had at least one eye on the power business in rendering its judgment, for reference is made to the effect upon the nation of permitting the states to take property off the national tax rolls. It may not have been viewed with any alarm by the previous Administration, but the Supreme Court sees it as a serious matter.

And if the Court takes this view with respect to local government ownership, are not all other normally tax-exempt bodies equally taxable? Surely if these arguments apply to a body with taxing power in its own right, such as a state, then they must apply to cooperative groups and others that have no such authority. The abdication of the national government in its taxing power largely to give aid and assistance to the social concept of the Administration is becoming very serious. The national government must be maintained by all its citizens without discrimination.

Residential Use Doubled in Last Eight Years

DURING THE WAR YEARS when virtually all residential sales activity ceased and only a few energy-consuming devices were available, the kilowatt-hour use per home, as shown in the statistics in this issue, increased nearly 30 percent. In the last eight years, four without promotion, the total residential use, exclusive of rural, has doubled. Is it too much to expect to double residential usage in the next five years? Is it even too much to try to double the use-per-home by the end of 1950?

By energetically going after residential sales, the utility industry was able to pull itself out of the depression a full year ahead of general business. Where its ratio of residential kilowatt-hour sales to total was 17 percent at the bottom of the depression, they increased to around 20 percent in the years before the war. Now they are down again around 17 percent. The problem in the next year or two is to try to boost them back to the 20 percent level.

The next few years can be very critical for the utility business, because of rapidly advancing costs. These must be met with income advancing faster than output. As is indicated by the past year's figures, when income increased while output fell off, this is possible by selling more of the higher priced energy. And since the margin between high and low priced energy is getting smaller and will continue to do so, the increase in residential use must be faster.

Life of Tubes for Utility Application

UTILITIES CAN HARDLY use electronic equipments for as many as 124 different applications in so few as 10 companies without being rated as significant users of tubes. There are several hundred different kinds and types of tubes available from which to select for these rather special applications. Some of these applications call for tubes quite similar to those needed by general industry as well as those which are found in the millions of radio sets. But the big difference with the other users is that the power companies rely on the tubes for positive life and performance—the public wants its power uninterrupted and a tube failure at an unexpected moment in a critical position can be as serious as any other failure would be if not backed up by reserves.

There have been negotiations with the tube manufacturers on this matter of tube life, and the Pennsylvania Electric Association committee which initiated them achieved a better understanding of the particular problems of application confronting the utilities. The manufacturers quite logically point to the difficulty of weaving the production of special guaranteed-life tubes into the mass output of consumer tubes. They also point to the absence of a truly indicative non-destructive test of tube life in advance of use in service.

Just as with every other piece of equipment on which they have cooperated with manufacturers during the developmental years, utility engineers will probably have to help establish the importance of good reliable tubes by field trial and field study. The field trials are under way—they have been going on for two decades or more—but the field studies of tube life and performance have only begun. There is real occasion now for all users of electron tubes to record the date of installation, the hour-duration of filament-energizing and the volts and amperes to which they have been subjected before they got waveringly weak or ceased operating entirely. That will help give the tube producers the facts on which they can turn out more durable and dependable tubes. It is not impossible to make tubes that will last 20,000 or more hours as evidenced in the tubes used in the repeater stations on the Bell lines.

The other thing the utilities can do is to contribute research and ingenuity toward creating a non-destructive test equipment that will tell with dependability how long any given tube is likely to last in service. That would be an alternative to sampling and test to destruction.

Those two measures would, if perfected and broadly applied, measurably enlarge the scope of an already active interest in electronics on the part of power companies.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

Ickes Picks Battleline for Federal Power Fight

HAROLD ICKES has laid on the line the principles on which he wants the nation's most extensive power holdings to be operated, and his reasons for doing so are as interesting as his principles are blunt.

It was quickly apparent when the Secretary of the Interior released his power policy recently that it contained nothing new and little which could easily be attacked. Much of it had been publicly stated Interior Department policy for years. The remainder had also been policy, even though not publicly declared to be so.

Why did Ickes choose this time to "string out the obvious for the delectation of fools," as the late Justice Holmes put it?

Picking the Line of Battle

One possibility which will do until Ickes writes this memoir is that he was picking the line on which Purcell L. Smith and his National Association of Electric Companies will have to fight the next engagement of the battle which private power has been waging in Congress recently.

While Smith and the NAEC members who have been telling their story to Congress for some months now haven't won any visible complete, conclusive victories, neither have they been routed. Their presentations and the results which logically may be attributed thereto have been better than many, even in the industry, had anticipated. It can hardly be pleasing to the public power crowd, which has had the run of Capitol Hill for well over a decade now, to see opposition arise which makes the sense that recent NAEC witnesses have made.

If the Ickes power policy be a move to dictate the sites of future encounters, it is far from being a dull one. In troubling to draw up and publicize his policy, Ickes is digging into a position which, while not unassailable, has the advantage of being readily defendable. He cites chapter and verse of the public laws which he believes sustain his position. He repeats citations often enough to make it overclear that they are policies written not into one law alone but into statute after statute. He has refrained from stretching these statutes to tortured limits. Thus he makes it apparent that these policies are not 1946 models, dating back to 1906 as some do.

Where his lines extend beyond the point that a strict interpretation might justify without argument, they are close-knit, and rest on points which can more easily be defended than attacked in the rough and tumble of Congressional debate. Ickes now lies back on well drawn lines, able to point to statutory law as justification when his broadening activities are attacked. Perhaps frontal assault can overrun the position which public power has been building up over the years, but anything short of that can hardly do so.

Program's Vulnerable Spot

The weakest spot in the Ickes armor is the fact that he still has to go to Congress for appropriations for those steam plants and transmission lines. It begins now to look as if Ickes did private power a favor two and one-half years ago when he overruled the Congress and built the Shasta-Oroville line out of unexpended balances after he was refused funds for it. The reaction was so intense that Interior has not dared to do so since, much as its dream of a Central Valley transmission grid could stand it now.

But even under this limitation, Ickes undoubtedly rests easier now that his policy is there for all to see. It is now just that much easier for Ickes to say, when NAEC objects to appropriations for transmission lines or steam plants, that while Congress controls the purse strings, it has already said, unmistakably, in this, that and the other law, that it favors public power in about every possible way.

At this point, NAEC will have to demonstrate not that the ABC transmission line is a bad investment, but that U. S. policy is. This may not put NAEC in as tight a spot as Ickes would prefer to heat up for it, but it will not make the task any easier.

Some portions of his policy Ickes may find hard to defend, but to lop them off would not necessarily scotch the serpent. In the days when economy may be popular on Capitol Hill, Ickes may have trouble defending one of his policies which is not specifically backed up by law and which calls for duplication of investment. That would be the provision that federal hydro projects shall have their own steam standby where necessary to independent operation. Ickes has struck out repeatedly on the Antioch and Delta steam plants of the Central Valley project largely because Pacific Gas and Electric has offered to buy and sell Shasta hydro output as firm energy, at rates set by the Federal Power and California commissions respectively.

Help in Local Politics

Ickes' insistence on "active assistance, from the very beginning" to public bodies and cooperatives which might be organized to buy Interior power testifies to the public power crowd's realization that thus far, private power is the big market for the output of public hydro, regardless of whether this be entirely true in every section. Whether Ickes will be any more successful in the future than he has been in municipalizing San Francisco remains to be seen, but on the basis of his announced policy, the not inconsiderable resources of the Interior Department are going into local politics seeking the extension of public ownership, and it's there in black and white that Congress wants it to do so.

An interesting angle protrudes from Ickes' edict that wholesale contracts shall contain resale rate and other provisions aimed at getting energy to the consumer at the lowest possible rate, as near cost as possible, namely the extent to which state commissions may feel encroached upon by the stipulations of the ideologists. It would be no departure from form to see such contracts attempt to bar any charge for return on the investment in facilities necessary to distribute energy bought at cost.

NEWS OF THE WEEK

New York's Bottled Water Business Must Pay Taxes

Supreme Court, by 6 to 2 Decision, Declares Business Activities of States Can Be Taxed by Federal Government—Differences among Justices Likely to Stop Congress from Taxing Municipal Power Systems

The Supreme Court ruled by a substantial margin this week that New York State's bottled water business is subject to federal taxation, but the implications of its decision were obscure.

Although the court upheld by a 6-2 vote two lower courts which had denied the state's contention that its Saratoga Springs mineral water traffic was immune from federal levy, the six-man majority was far from agreement on the precise delineations of state immunity from federal taxes. The eight justices delivered four opinions, three upholding the lower courts and one dissenting, but none was cited as "the opinion of the court," the designation almost always assigned to the opinion prepared by the justice who announces the court's position.

In sharp contrast to such normal procedure, Mr. Justice Frankfurter's presentation of the decision was headed simply with the statement that its author "announced the judgment of the court and delivered an opinion in which Mr. Justice Rutledge joined." There followed concurring opinions by Mr. Justice Rutledge and by Mr. Chief Justice Stone, who was joined by Justices Reed, Murphy, and Burton. Mr. Justice Douglas and Mr. Justice Black joined in a dissenting opinion prepared by the former.

While Frankfurter opened wide the way for the imposition of taxes on municipal electric power systems, the extent to which the majority differed was believed by some Washington observers to be ample insurance that Congress would not impose such levies.

Justice Frankfurter started as if to make short work of the case, which found attorneys general of 45 states and several other intervenors, including the American Public Power Association, joining New York State in its attack on the tax and the principle. Citing the "South Carolina case," wherein the Supreme Court denied federal tax immunity to a state-owned liquor system, he asserted that "we certainly see no reason for putting soft drinks in a different Constitutional category from hard drinks." He declared, however, that the principle could stand to be further spelled out and proceeded to do so by labelling the concept of reciprocal tax immunity between state and federal governments as an assumption.

He said the "South Carolina case" made a delineation between taxable and non-taxable state functions on the basis of "historically recognized governmental functions," then discarded such a distinction with the comment that "it could hardly remain a satisfactory Constitutional doctrine that only such state activities are immune from federal taxation as were engaged in by states in 1787."

Another case, where the distinction between taxable and non-taxable state functions was based on things "normally" taxable, Frankfurter discarded with the comment that "to rest the federal taxing power on what is 'normally' conducted by a private enterprise in contradiction to the 'usual' governmental functions is too shifting a basis for determining Constitutional power and too entangled in expediency to serve as a dependable legal criterion."

Frankfurter then discarded the theory that a state should be immune from federal taxation of an enterprise "generally pursued" merely because it be connected with a state's conservation policy.

"We have already held that by engaging in the railroad business a state cannot withdraw the railroad from the power of the federal government to regulate commerce. Surely the power of Congress to lay taxes has impliedly no less a reach than the power of Congress to regulate commerce.

"There are, of course, state activities and state owned property that partake of uniqueness from the point of view of intergovernmental relations. These inherently constitute a class by themselves. Only a state can own a statehouse; only a state can get income by taxing. These could not be included for purposes of federal taxation in any abstract category of taxpayers without taxing the state as a state. But so long as Congress generally taps a source of revenue by whomsoever earned and not uniquely capable of being earned only by a state, the Constitution of the United States does not forbid it merely because its incidence falls also on a state. If Congress desires, it may, of course, leave untaxed enterprises pursued by states for the public good while it taxes like enterprises organized for private ends."

Opinion of Chief Justice Stone

In his concurring opinion, the chief justice asserted that he and his three colleagues "are not prepared to say that the national government may Constitutionally lay a non-discriminatory tax on every class of property and activities of states and individuals alike." Sidestepping Frankfurter's doctrine, Mr. Stone observed that "our difficulty with the formula . . . is that a federal tax which is not discriminatory as to the subject matter may nevertheless so affect the state, merely because it is a state that is being taxed, as to interfere unduly with the state's performance of its sovereign functions of government."

The Chief Justice further pointed out that taxing a business of a state on the

same basis as that of a citizen will not impair the functions of the government of the state. On the other hand, should the state expand its business activities, it would unduly curtail the national taxing power unless such business were taxed.

Justice Rutledge, joining in the majority position, declared, "Too much is, or may be, at stake for the nation to permit relieving the states of their duty to support it, financially as otherwise, when they take over increasingly the things men have been accustomed to carry on as private, and therefore taxable, enterprise. Competitive considerations unite with the necessity for securing the federal revenue . . ."

He expressed the opinion that before a federal tax can be applied to activities carried on directly by the states, Congress should make clear its intention to tax such activities of the states and not leave it to inference.

Mr. Justice Douglas based his dissent not on any difference between New York's mineral water business and the non-exempt liquor business of South Carolina, but rather on the contention that the entire South Carolina case rule was mistaken. Noting that "the doctrine of state immunity is too intricately involved in projects which have been launched to be whittled down by judicial fiat," Douglas asserted:

Social Program Needs Protection

"The fact that local government may enter the domain of private enterprise and operate a project for a profit does not put it in the class of private enterprise for tax purposes . . . if the federal government can place the local governments on its tax collectors list, their capacity to serve the needs of their citizens is at once hampered or curtailed . . . many state activities are in marginal enterprises where private capital refuses to venture . . . add to the cost of these projects a federal tax and the social program may be destroyed before it can be launched. . . ."

Douglas closed with what has become the rallying cry of public power proponents who attempt to belittle the tax inequality between private and public ownership when he declared,

"There is no showing whatsoever that an expanding field of state activities even faintly promises to cripple the federal government in its search for needed tax revenues. If the truth were known, I suspect it would show that the activity of the states in the fields of housing, public power and the like has increased the level of income of the people and have raised the standards of marginal or submarginal groups. Such conditions affect favorably, not adversely, the tax potential of the federal government."

LOWER RATES APPROVED — **Gordon Persons, president of the Alabama Public Service Commission, signs the commission's order approving a decrease in rates for domestic and rural customers of Alabama Power Co.**

Georgia Power Must Get License for Oconee Dam

An order by the Federal Power Commission requiring the Georgia Power Co. to apply for a license to construct a hydroelectric plant on the Oconee River, in Georgia, has been affirmed by the United States Fifth Court of Appeals at New Orleans.

The court held that the proposed project would affect navigation, and that FPC could require a license since interstate or foreign commerce would be affected.

Georgia Power proposed to build a dam across the Oconee 4.3 miles upstream from Milledgeville. The commission ruled that the river is navigable from a point 4 miles below the proposed dam site to its mouth, and said the proposed structure would affect navigation because it would reduce navigable depths of water below the dam.

The utility, in asking reversal, asserted the Federal Power Act did not apply to a non-navigable part of the stream.

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Central Ohio Light Reveals $650,000 Expansion Plans

Central Ohio Light & Power Co. is planning an expansion program to cost more than $650,000. Major feature will be the installation of new steam generating equipment in the Woodcock plant near Bluffton and construction of a second circuit extending from that plant to the Findlay plant, involving the erection of a 34,500-volt line. The program will provide an additional 20,000 hp. in Findlay.

Another P.U.D. Joins Group to Buy Utility

Snohomish County P.U.D. Signs Contract after Making Own Survey of Puget Sound Power Proposition

Organization of Washington state's 15 P.U.D.'s to purchase Puget Sound Power & Light Co. properties for $135,000,000 was a step nearer completion last week when one of the two objecting districts signed the purchase contract.

The action was taken by the Snohomish County P.U.D. which, along with the Whatcom County P.U.D. had refused to participate in the transaction until an independent survey of the properties was obtained.

In signing the contract, the Snohomish P.U.D. commissioners agreed to enter into a 50-year contract for operation of the major generation and transmission properties of the private concern.

The action followed several conferences, one of which included members of Seattle City Council Utilities Committee and E. R. Hoffman, superintendent of the City Light Dept., and Dr. Paul J. Raver, Bonneville Power Administrator.

Snohomish P.U.D. officials had been reluctant to enter the transaction without consultation with officials of Seattle where almost one-third of Puget properties are situated. Their ultimate action followed on the heels of a 60-day study of the purchase proposal by Guy C. Myers, fiscal agent for the districts, and left only action of Whatcom officials as the concluding link of the transaction. In moving to participate in the purchase plan, Snohomish commissioners stated that they were concerned with protection of interests of the people of Snohomish County and of the state in general, in securing the public power program.

For the study, the district retained the firm of Jay Samuel Hart of Chicago, consulting engineers. The firm's report, the commissioners said, included not only a special study of Snohomish County's interests, but also included a definite review of the position of Seattle and BPA in the transaction.

They stated the report shows the purchase plan as offering a "fair and equitable proposition, not only for the P.U.D.'s involved, but for the people of Seattle, the stockholders of the company and also for the Federal government as represented by BPA."

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Utility Will Expand Lines

New Mexico Power Co. has announced that it will expand its lines at a minimum cost of $200,000.

Electric Equipment Output Drops as Workers Strike

United Electrical Union Calls Out 200,000 Members at 79 Plants of General Electric, Westinghouse, and Electrical Division of General Motors to Enforce Demands for Increase of $2 a Day for All Workers

Production of electrical equipment from the heaviest apparatus to the lightest appliances was seriously slowed down in the United States Tuesday morning when members of the United Electrical, Radio and Machine Workers of America, an affiliate of the Congress of Industrial Organizations, went out on strike at all plants of the Westinghouse Electric Corp., General Electric Co. and the Electrical Division of the General Motors Corp. Seventy-nine plants in 16 states are affected. No negotiations to settle the strike were in progress late this week.

The total number of workers on strike was approximated at 200,000, but the number of workers affected will be much higher as the effect of the strike reaches office employees, distribution and sales staffs, and later contractors. Mass picketing has ended production at all plants.

Companies Offer Raises

The Union demand of an increase of $2 a day was denied by all three manufacturers. General Electric offered to increase wages of all workers earning less than $1 an hour 10 cents an hour, with a 10 percent increase for all earning over that figure. Westinghouse offered a 45-hour work week with time and a half for the last five hours. General Motors offered 13½ cents an hour.

In a statement released by Charles E. Wilson, the G.E. president pointed out that one of the principal sections of the economy that will feel the direct effects of the strike is the electric utility industry, which is badly in need of electric generating and distribution equipment to replace and augment that which became worn out or obsolete during the war production years.

"Because electric power is necessarily the keystone of most reconversion and modernization programs, any enforced delay suffered by electric service companies is bound to have almost endless ramifications in the American business scene," Mr. Wilson said.

"Vitally conscious as we are that the supply of electric power must be maintained, the entire organization of the company not affected by the strike will be alert and anxious to meet any emergencies that may arise. Our field organization will endeavor to keep in close touch with their individual customers," Mr. Wilson promised.

"It will be impossible either to receive materials at or to ship equipment from any of our plants until after the strike has been settled and the workers returned to their jobs," the G.E. president said. "We have had to request vendors to hold up on the delivery of any materials to G.E. plants during this period. Obviously we shall be unable to make any promises as to delivery of equipment. We can and do promise that we will return to a normal schedule as soon as possible in order that the requirements of our customers in all parts of industry will be served promptly and satisfactorily."

The appliance market, he indicated, will also have to wait for the flow of appliances to resume.

In his statement, A. W. Robertson, chairman of the board of Westinghouse, criticized the union sharply for making unfair and impossible demands. In explaining the wage situation, he said,

"The average hourly pay of all Westinghouse male hourly paid employees, not including any overtime, has increased 33 percent since January, 1941—equal to the increase in the cost of living over the same period.

"As of November, 1945, the average earnings of Westinghouse hourly paid male employees, including overtime, were $1.35 per hour—15 percent more than the average for 25 major industries, according to the National Industrial Conference Board.

"We cannot afford to move still further out in front of our competitors without seriously hurting the company's ability to stay in business.

"Furthermore, the union offers nothing in return for this wage demand—not even the increase in productivity that is needed to maintain existing wage rates. Wages can be raised only through an increase in production.

"To pay a $2.00 a day increase as demanded by the union would require approximately $3,750,000 monthly, or about $42.00 for each employee in a 21-workday month. This pay would have to come from the money Westinghouse receives from its customers. The company is not making that much money now. In November, the latest month for which we have complete figures, operating profit was but $464,925. If all of this had been divided among the 90,000 Westinghouse workers, it would have given them $5.17 each, or $36.83 short of the $42 per month the union is now demanding.

"We would be glad to enter into any proceedings and present the pertinent facts to a fact-finding board.

"We are against a runaway inflation, but it is almost inevitable that prices go up. If they do, this would affect our attitude on further wage readjustments."

WELL DONE—After 40 months, "Treasury Center," Chicago's unique war loan operating base and exhibit located in Commonwealth Edison Co.'s store was closed recently, leaving behind a record of nearly $12,500,000 in bond sales. Space for the center was donated to the U. S. Treasury Department by the Chicago utility. Edward J. Doyle, left, president of Commonwealth, receives a citation of the Secretary of the Treasury from Renslow P. Sherer, chairman of the War Finance Committee of Illinois, "for the outstanding service rendered by the company to the war finance program"

Expansion Planned by Connecticut Light

$22,000,000 Five-Year Improvement Program Now Underway—Ground Broken for 45,000-Kw. Unit at Devon

Active field work in the construction of Connecticut Light & Power Co.'s $22,000,000 five-year improvement program began recently with the breaking of ground at the Devon plant of this utility, for the installation of a 45,000-kw. turbo-generating unit. Plans are still being worked upon for additions to the transmission and distribution facilities, including 800 miles of new rural lines, rehabilitation of equipment, and the installation of a 31,250-kw. turbo-generator at the Montville station near New London.

Included in the Devon construction now under way will be a building addition and the installation of a 69-kv. substation. The new generator, a 3,600-rpm. machine, is hydrogen cooled and will deliver 13.8 kv. to a 50,000-kva. transformer bank in an outdoor substation for transmission to load centers at 69 kv. High-voltage switching will be used, and unit auxiliaries will be supplied from a 5,000-kva. transformer connected to the generator leads. The turbine steam supply will be from two 225,000-lb. per hr. boilers operating at 850 psi and 925 deg. F. This unit is scheduled for operation early in 1947.

Montville Unit Scheduled For 1947

The new Montville unit is to be installed early in 1947 to replace two 10,000-kw. units which went into service in 1918. It will be hydrogen cooled, running at 3,600 rpm. and delivering energy at 13.8 kv. to an outdoor transformer substation for 69-kv. transmission to load centers. Electrical arrangements are similar to Devon's. The turbine, however, will be supplied from one 300,000-lb. per hr. boiler at 850 psi and 950 deg. F. Detailed engineering on this project is under way, and the major equipment has been purchased.

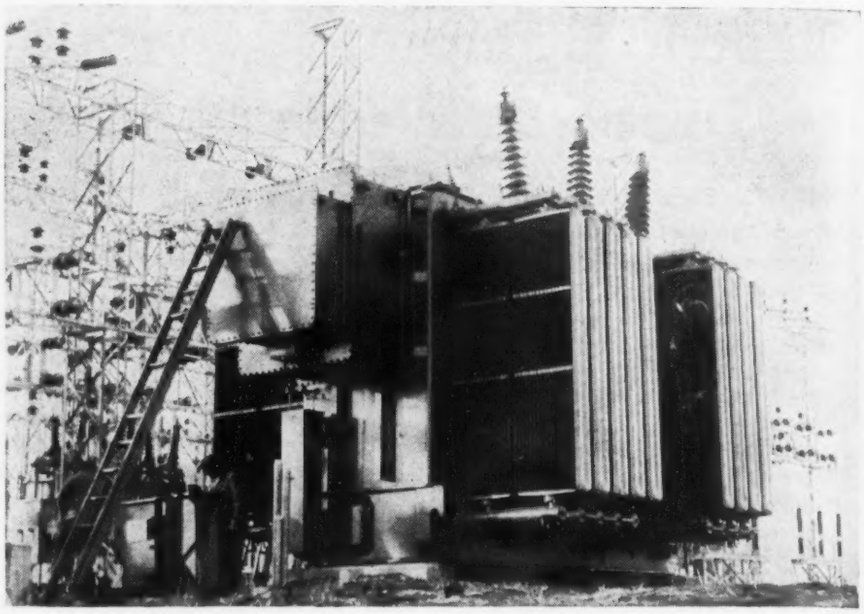
The existing 69-kv. transmission line from Montville to the company's Southington substation, 48 miles, is being rebuilt for 115-kv. operation, and service from this line should be available in 1946. At Montville, the line will be connected to the 69-kv. substation bus through a voltage regulator and a 60,600-kva. autotransformer. At the Southington end a 66,667-kva. tap changing under load autotransformer connects to the 69-kv. substation bus. Recently delivered to this substation, the transformer is the largest in Connecticut.

From Devon a 28-mile tap line will be built to connect with the Southington-Montville 115-kv. line about 6 miles from Southington. This line will be connected to the Devon 69-kv. bus through a 66,667-kva. tap changing under load autotransformer. At this time complete reconstruction of the old Southington 69-kv. switching structure is rapidly nearing completion.

To supply customers in Bristol formerly served from another system, it is planned to build in 1946 a 2-circuit, 69-kv. line from Southington to Bristol, about 8 miles. Several 69-kv. transmission lines are planned in this five-year program to reinforce service in central and eastern Connecticut from Montville. In western Connecticut similar facilities will be provided. The company's seasoned plan to supply local load centers at subtransmission voltages will be actively continued, usually at 27.6, 22 or 13.8 kv. These feeders terminate at load centers where automatic tap changers supply the local distribution facilities.

New service buildings are also on the program for Bristol and Seymour.

President C. L. Campbell of C. L. & P. recently stated that he believes this sizable program will encourage industrial expansion in Connecticut and will aid as a major step in furnishing returning veterans with jobs, thus helping to avoid a possible unemployment problem.



TAP CHANGING UNDER LOAD—Employees of Connecticut Light & Power Co. change taps under load on 124-ton autotransformer at Southington substation which will provide a 66,667-kva. tie between the 69-kv. bus and the 115-kv. line to Montville

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Utility Will Extend Lines

Portland General Electric Co. will build 217 miles of rural lines in seven Oregon counties at a cost of $260,000.

'45 Grand Coulee Output Was 4,888,000,000 Kw.-Hr.

Grand Coulee power deliveries during 1945 were 4,888,000,000 kw.-hr., producing one-third of all electric energy in Washington, Oregon, Idaho, Montana and Utah, it was recently announced by R. J. Newell, regional director at Boise, Idaho.

With the peak monthly delivery in January, 1945, at 556,983,560 kw.-hr., a record approaching the all-time high of March, 1944—621,119,000 kw.-hr.—the year-end report shows that entire power deliveries now stand at more than 17,000,000,000 kw.-hr. Nearly all energy after 1941 was delivered to war industries in the Pacific Northwest, including the Hanford atomic bomb plant, five aluminum reduction plants, and twelve other metal production plants.

In 1944, when these industries were operating at maximum speed, Grand Coulee showed a peak delivery of 6,000,000,000 kw.-hr. However, the 1945 figures are 24 times as high as 1941 deliveries, are over twice as high as 1942's, and are far beyond 1943's figure of 4,100,000,000 kw.-hr.

The deliveries were made from eight giant generators, of which six are the world's largest. Work is currently progressing on a west bank powerhouse at Grand Coulee, where three 108,000-kw. generators will increase the permanent power installations from 668,000 kw. to 992,000 kw. A companion powerhouse across the Columbia River, serving nine 108,000-kw. generators, can be added as needed.

Texas Utilities Co. Shows Principles of Integration

SEC, Using Holding Company Act as Guide, Authorizes Merger of Texas Power & Light, Texas Electric Service, and Dallas Power & Light—Companies Have Been Operated as North Texas Interconnected System

Principles of integration under the Holding Company Act are clearly exemplified by the newly organized Texas Utilities Co., which has been authorized by the Securities and Exchange Commission to take over properties formerly held by American Power & Light Co. and Electric Power & Light Corp.

Principal units of the new holding company are Texas Power & Light Co., Texas Electric Service Co., and Dallas Power & Light Co. These companies together serve some 60,000 square miles of territory and a population of 1,500,000, each figure representing something over 20 percent of the state of Texas.

The inherent integrability of the properties rests on their physical proximity and interconnections, the fact that they have been operated as part of the North Texas interconnected system, that they have 2,683 miles of communication circuits for dispatching the energy transfers over some 3,637 miles of transmission line, and that there are potential savings of 83,000 kw. in generating capacity representing annual savings of $1,363,350. Other factors established in connection with the integration were that the present system has evolved from some 17 isolated communities which have grown in electrical requirements until they now require some 380,000 kw. of generating capacity; also, they lie entirely within the state of Texas.

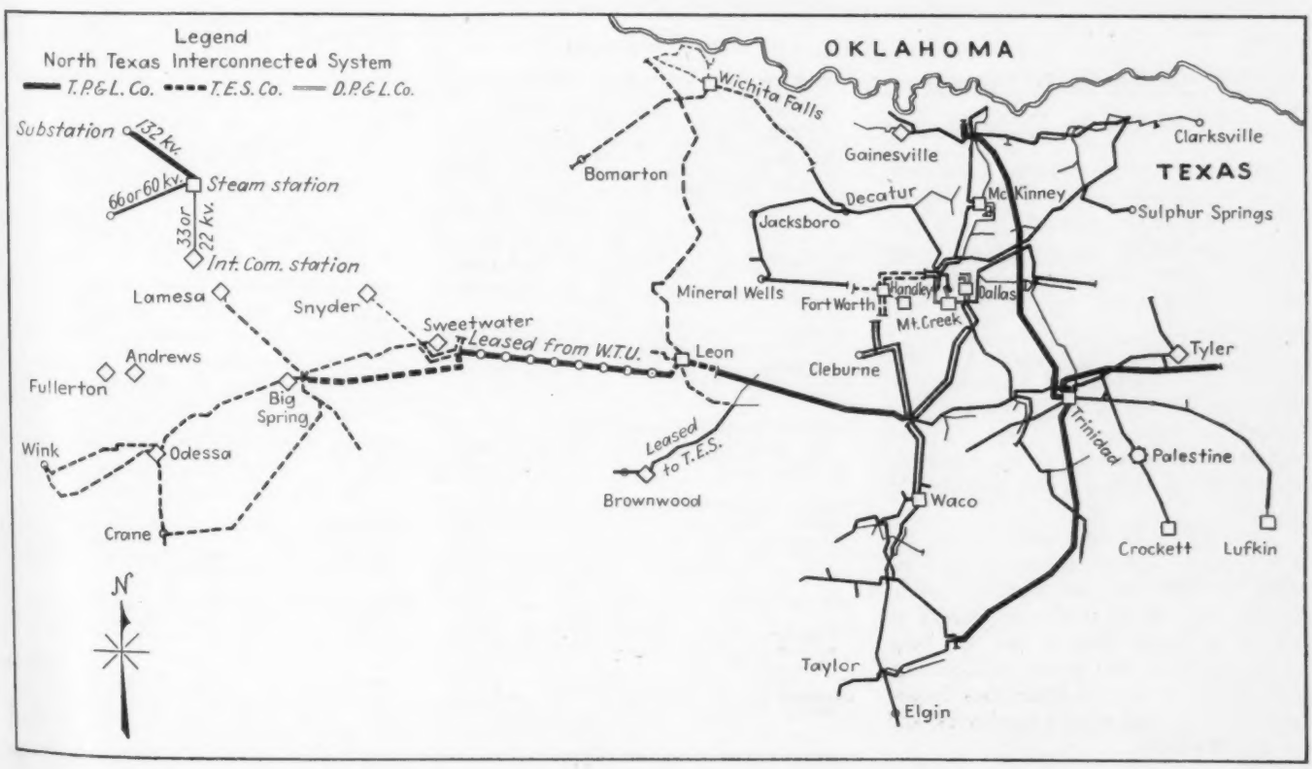
Areas served by Texas Power and Texas Electric Service are essentially of the same character; agricultural, dairying, cattle raising, and oil production dominate. The newly integrated property is dotted by oil refineries and fringed by coal fields. The Dallas Power territory is typical of a metropolitan area.

High-voltage transmission on the North Texas integrated system had its origin in the 60-kv. line built in 1913 between Fort Worth and Waco. Since then the mileage has grown until there are the following pole line mileages: 132 kv., 561.37 miles; 60 and 66 kv., 2,467.73 miles; 33 kv., 255.16 miles; and 22 kv., 353.06 miles; a total of 3,637.32 miles.

Savings in fuel costs resulting from sales in interchange of energy between system companies in 1944 was computed at $58,500. This was the value attached to some 8,500,000 kw.-hr. of identifiable economy sales and interchange out of 352,000,000 kw.-hr. interchanged. The system became in 1941 a definite component of the South West Power Pool, which was formed primarily to supply energy to the Arkansas aluminum plant. Benefits from coordinated operation of the system companies have amounted to some $1,200,000 over each of the last five years.

Taking 1944 as a representative sample, it has been computed that the savings resulting from reduction of generating capacity by coordinated operation of the property amounted to 71,500 kw. The total actual reduction of cost in power ($1,202,450) consists of $893,750 of fixed charges, $25,250 of standing charges, and $58,500 in fuel costs.

It is expected that utilization of government-financed hydro power and energy will be beneficial. The system has been developed along coordinated lines to provide an adequate power supply to the entire service area. Hydro power can be transported to market with a minimum of capital expenditure, and the system can absorb the low load factor power and energy available on the hydro projects because Texas loads are of an appropriate character. Further, the steam generating plants may be operated on off-peak hours so as to conserve power on the dams during low water periods. Approximately 83,000 kw. of capacity were reported to be available as a reduction in



capacity required under such coordinated operation. This consists of 26,000 kw. arising from a diversity of 4.72 percent. Another factor is the reduction of 47,300 kw. required for reserves under coordinated operation (99,800 kw. for independent operation less 52,500 kw. for coordinated operation).

The final item is a reduction of 9,700 kw. in surplus capacity resulting from the decrease from 29,240 kw. for independent operation to 19,540 kw. for coordinated operation. This all results in a net saving of $1,002,000 resulting from coordinated operation. Fuel savings are estimated to be $91,350 and payroll maintenance and supplies charges of $270,000. These are what make up the $1,363,350 of estimated total savings resulting from coordinated operation to meet a system load of 525,000 kw.

In 1944, the three companies had an average of 392,480 customers. From a total capacity of 379,540 kw., they generated 2,494,635,000 kw.-hr. of power. Revenues from sales of energy were $37,759,743. Of this total, $11,821,325 came from residential sales, $11,093,704 from commercial sales, $10,415,465 from industrial sales, and the remainder from rural, government and municipal, and other miscellaneous sales.

System diversity factor of 1944 was 95 percent with a demand upon the three companies for July, 1944, of 424,500 kw. This was a mid-afternoon peak; the actual demand on the generating plants of the companies at the same time was 363,200 kw., the rest of the demand being met by imported capacity.

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12.75% Raise Ends Threat of Strike in New Jersey

All threats of a strike by 3,500 electrical employees of the Public Service Electric & Gas Co., Newark, N. J., which would have left 80 percent of New Jersey without power, have been ended by a raise of 12.75 percent and better working conditions.

The employees, represented by eleven locals of the International Brotherhood of Electrical Workers, an affiliate of the American Federation of Labor, at first demanded a 30 percent raise. Later the men voted to strike unless they got 15 percent.

Improved working conditions in the new contract which is retroactive to May, 1945, include pay for overtime meals, twelve paid holidays a year instead of eleven, a higher rate of pay for long-term employees who cannot perform regular duties because of disabilities, longer vacations for long-service employees, and longer sick leave.

Bay State Board Wins Preferred Stock Suit

Massachusetts Department of Public Utilities won a full bench decision of the State Supreme Court last week against an appeal of the Lowell Gas Light Co. to set aside a ruling of the commission against the issuing of 30,481 preferred stock shares in place of the same number of common shares, representing one-half the equity capital of this utility.

The commission held that this transaction was essentially a bookkeeping procedure; that no money was to pass in the proceedings; and that its necessity in the operations and service of the company was not proved. The high court pointed out that the record in the case showed that if the plan went through, the utility would save about $40,000 per year in Federal taxes through making returns in conjunction with the American Utilities Associates, a holding company owning 98 percent of the stock.

The court conceded that differences of opinion might exist as to the value of the proposed change in securities in connection with improving their market aspects and thus making it easier to procure additional funds for future improvements in the property; but held that it was the commission's task to weigh such points and determine the necessity for security issues. No error of law affecting the decision of the commission was found by the court which ordered the suit against the commission by the utility dismissed.

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Ark-La Appeal Granted

Little Rock Circuit Court has granted Ark-La Electric Cooperative authority to appeal to Arkansas Supreme Court a decision by the Circuit Court holding Ark-La to be a public utility and subject to regulation by the Arkansas Public Service Commission. Little Rock Circuit Court upheld a ruling by the Commission which held that Ark-La, formed in 1941 to supply power to the Jones Mill Aluminum plant from Grand River Dam in Oklahoma, was a public utility.

MEETINGS

American Society of Mechanical Engineers—Spring meeting, Hotel Patten and Reid House, Chattanooga, Tenn., April 1-3. Ernest Hartford, executive assistant secretary, 29 W. 39th St., New York 18, N. Y.

Southeastern Electric Exchange—Engineering and Operation Section, Tutwiler Hotel, Birmingham, Ala., March 14-15; Annual conference, Edgewater Gulf Hotel, Edgewater Park, Miss., April 24-26. J. W. Talley, executive secretary, 303 Haas-Howell Bldg., Atlanta 1, Ga.

Previously Listed

Pennsylvania Electric Association—Business Development Section—Customer contact committee, PEA Headquarters, Harrisburg, Pa., January 24. H. S. Metcalfe, chairman of Section, West Penn Power Co., Pittsburgh, Pa. Systems operation committee, Roosevelt Hotel, Pittsburgh, Pa., February 6-7; A. R. Deck, chairman, Metropolitan Edison Co., 412 Washington St., Reading, Pa. Transmission and distribution committee, Benjamin Franklin Hotel, Philadelphia, Pa., February 7-8; C. C. Moler, chairman. The Potomac Edison Co., Hagerstown, Md. Electrical equipment committee, Roosevelt Hotel, Pittsburgh, Pa., February 14-15; B. E. Hagy, chairman, Philadelphia Electric Co., 900 Sansom St., Philadelphia, Pa.

American Institute of Electrical Engineers—Winter convention, New York, N. Y., January 21-25; northeastern district, Buffalo, N. Y., April 24-25. H. H. Henline, secretary, 33 W. 39th St., New York 18, N. Y.

Institute of Radio Engineers—Winter technical meeting, Astor Hotel, New York, N. Y., January 23-26. Haraden Pratt, secretary, 330 W. 42nd St., New York 18, N. Y.

Illuminating Engineering Society—East Central Regional Conference, Bellevue-Stratford Hotel, Philadelphia, Pa., January 31-February 1. A. H. Manwaring, chairman, Philadelphia Electric & Mfg. Co., 1228 N. 31st St., Philadelphia, Pa.

National Association of Purchasing Agents—Public Utility Buyers' Group, midwinter convention, Edgewater Beach Hotel, Chicago, Ill., February 4-5. R. C. Wenz, chairman, Philadelphia Co., Pittsburgh 19, Pa.

Canadian Electrical Association—Winter conference, Chateau Frontenac, Quebec City, February 11-12. B. C. Fairchild, managing director, 704 Tramways Bldg., Montreal, Canada.

Missouri Valley Electric Association—Power sales conference, Hotel Continental, Kansas City, Mo., February 13-14; engineering conference, Hotel Continental, Kansas City, Mo., April 10-12. I. D. Pettegrew, director, 1004 Baltimore St., Kansas City 6, Mo.

Edison Electric Institute—Transmission and distribution committee, Netherland Plaza Hotel, Cincinnati, Ohio, February 18-19; electrical equipment committee, Netherland Plaza Hotel, Cincinnati, Ohio, February 20-21; general sales conference, Edgewater Beach Hotel, Chicago, Ill., April 2-4. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

American Society for Testing Materials—Spring meeting, Pittsburgh, Pa., February 25—March 1, R. E. Hess, assistant secretary, 260 S. Broad St., Philadelphia 2, Pa.

National Rural Electric Cooperative Association—Annual meeting, Buffalo, N. Y., March 4-6, Avery C. Moore, secretary-treasurer, 416 5th St., N. W., Washington 1, D. C.

North Central Electrical Industries—Convention and trade exposition, Radisson Hotel, Minneapolis, Minn., March 11-13. W. A. Ritt, secretary-manager, 234 Foshay Tower, Minneapolis, Minn.

Midwest Power Conference—Annual meeting, Palmer House, Chicago, Ill., April 3-5. S. E. Winston, director, Illinois Institute of Technology, Chicago 16, Ill.

National Electrical Manufacturers Association—Spring meeting Palmer House, Chicago, Ill., week of April 8. W. J. Donald, managing director, 155 E. 44th St., New York 17, N. Y.

Electrochemical Society—Spring meeting, Tutwiler Hotel, Birmingham, Ala., April 10-13. Colin G. Fink, secretary, Columbia University, 3000 Broadway, New York 27, N. Y.

National Electrical Wholesalers Association—Annual convention, Stevens Hotel, Chicago, Ill., April 21-25. C. G. Pyle managing director, 500 Fifth Ave., New York, N. Y.

International Lighting Exposition—Stevens Hotel, Chicago, Ill., April 25-30. A. B. Coffman, manager, 111 W. Jackson Blvd., Chicago 54, Ill.

Output Advances Sharply

The electric output curve moved sharply upward during the week ended January 12, 1946, according to preliminary figures released by the Edison Electric Institute.

E.E.I. placed the estimated amount of electrical energy distributed by the light and power industry for the week ended January 12 at 4,170,000,000 kw.-hr., compared with 3,865,362,000 kw.-hr. (revised) during the preceding week. During the week ended January 13, 1945, the amount of electrical energy distributed amounted to 4,614,334,000 kw.-hr. This year's estimate is a 9.6% drop.

Weekly Output Millions Kw.-Hr.

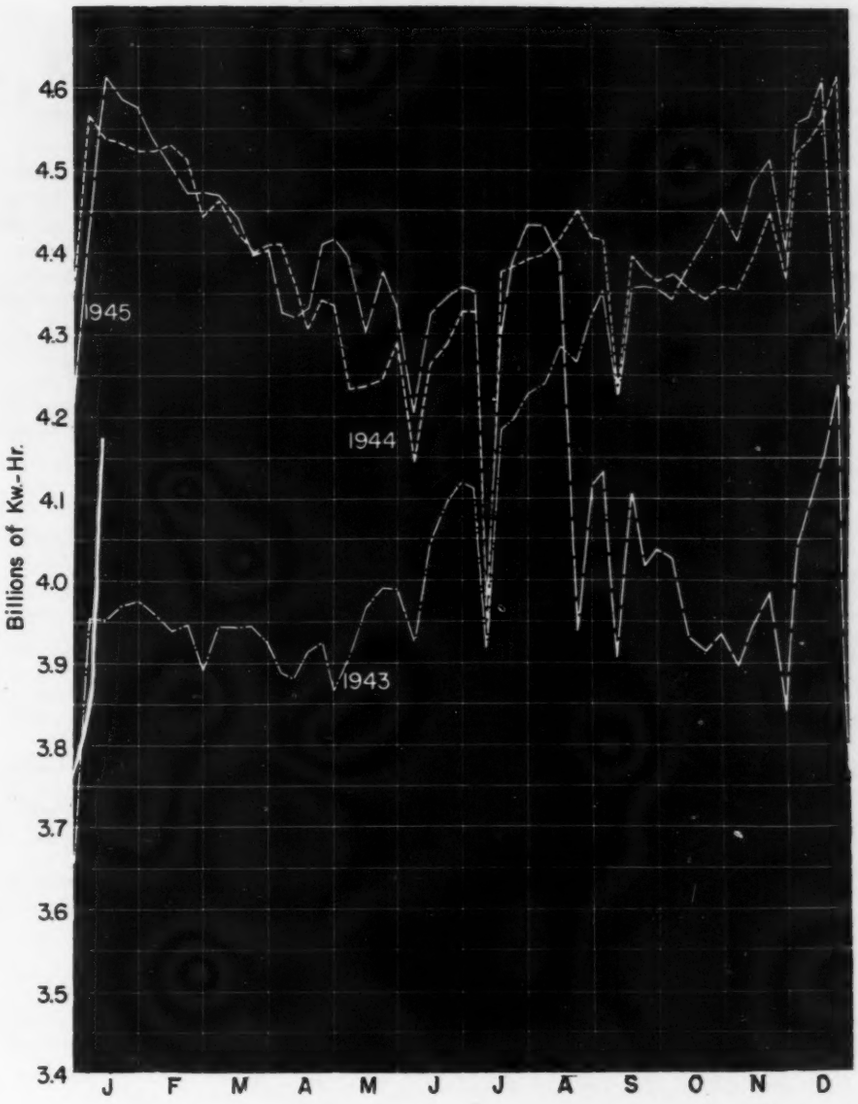
1946		1945		1944	
Jan. 12	4,170*	Jan. 13	4,614	Jan. 15	4,539
Jan. 5	3,865	Jan. 6	4,427	Jan. 8	4,568
1945		**1944**		**1943**	
Dec. 29	3,759	Dec. 30	4,226	Jan. 1	4,337†
Dec. 22	4,239	Dec. 23	4,617	Dec. 25	4,295
Dec. 15	4,154	Dec. 16	4,563	Dec. 18	4,613
Dec. 8	4,097	Dec. 9	4,538	Dec. 11	4,567
Dec. 1	4,043	Dec. 2	4,524	Dec. 4	4,560
Nov. 24	3,841	Nov. 25	4,369	Nov. 27	4,403
Nov. 17	3,985	Nov. 18	4,450	Nov. 20	4,513
Nov. 10	3,948	Nov. 11	4,397	Nov. 13	4,483
Nov. 3	3,899	Nov. 4	4,355	Nov. 6	4,414
Oct. 27	3,937	Oct. 28	4,358	Oct. 30	4,453
Oct. 20	3,915	Oct. 21	4,345	Oct. 23	4,415

†1944.

Percent Change from Previous Year

	Week Ending		
	Jan. 12*	Jan. 5	Dec. 29
New England	— 3.9	— 7.5	— 4.5
Mid Atlantic	— 4.9	— 6.7	— 4.8
Central Industrial	— 11.7	— 14.3	— 13.0
West Central	— 0.2	— 2.3	— 1.7
Southern States	— 11.0	— 14.7	— 15.3
Rocky Mountain	— 0.2	— 4.8	— 1.2
Pacic Coast	— 16.1	— 20.1	— 14.1
Total United States	— 9.6	— 12.7	— 11.0

* Preliminary. Final figures delayed by wire strike.



If Detroit Doesn't Appeal Utility Will Make Refund

Upon the City of Detroit's reaction to an Ingham Circuit Court decree approving the plan rests the chances of an immediate start on refunding $16,450,000 to 803,000 Detroit Edison Co. customers.

James H. Lee, assistant Detroit corporation counsel, said he would have to confer with Corporation Counsel Dowling and Detroit City Council before he could say whether an appeal would be made to the Michigan Supreme Court.

Circuit Judge Archie D. McDonald, Hastings, signed the decree on December 31 following lengthy argument and testimony. He noted that Detroit Edison's refund offer and a $3,000,000 rate cut for 1946 had the approval of the Michigan Public Service Commission.

Calling attention to the fact that the utility had stated its position, Judge McDonald commented: "It would be so much red tape to remand the matter to the Commission. I will sign the decree. This litigation started in 1942, and the decree should bring at least some termination of the matter."

George C. Dean, Hastings, Mich., attorney, was designated by the jurist as trustee for the distribution of the $16,450,000 fund as Edison officials announced that they were ready to issue refunds under the trustee's supervision almost immediately if the City of Detroit does not appeal. Refunds, involving issuance of 1,000,000 or more checks, could be completed in four months, they said.

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$10,000 Rebate Ordered

The Citizens Utilities Co. of Nogales has been ordered by the Arizona Corporation Commission to rebate $10,000 to residential customers in the form of credit on billings. The commission order is based on 1945 excess power charges.

I.B.E.W. Petitions Denied by New Brunswick Board

The Regional Labor Board of New Brunswick has rejected two applications of the International Brotherhood of Electrical Workers.

One was for certification of the union as the bargaining agent for employees of the New Brunswick Power Co. The board ruled that an agreement on collective bargaining is in effect between the company and the Amalgamated Association of Street Railway Employees and that ten months of such agreement have not passed.

An application for similar certification for employees of the New Brunswick Electric Power Commission was refused on the ground that the commission is a corporation acting for and in behalf of His Majesty, King George, and therefore does not come within the labor regulations and the board.

SEC DECISIONS—HEARINGS

The Securities and Exchange Commission recently issued a series of orders affecting electric utility companies.

PENNSYLVANIA POWER & LIGHT CO. proceedings before the SEC, relating to the simplification of the company's capital structure, have been terminated. The commission also lifted its restriction prohibiting payment by Pennsylvania of any further dividends on its common stocks in excess of 25 percent of net earnings available for such stock. The utility is a subsidiary of National Power & Light Co., which, with its parent, Electric Bond & Share Co., were parties to the proceedings. The latest action follows the recent recapitalization of Pennsylvania, which was approved by the SEC Oct. 26, 1945. In its order approving the plan, the commission said it provides "for the elimination of the circumstances which lead to the institution of proceedings against the company, and to the restriction against the declaration of payment of dividends on the common stock." (Release No. 6359).

UNITED CORP. has received permission to be a party to the Commission's proceedings on the plan proposed by United Gas Improvement Co. to exchange certain of its portfolio for outstanding U.G.I. common stock. U.G.I. is a statutory subsidiary of United Corp., which controls 26.1 percent of the former's voting securities. The plan as proposed by U.G.I. has been worked out in conjunction with United Corp. (Release No. 6355).

WISCONSIN POWER & LIGHT CO. received permission to withdraw a declaration in respect to a proposal on voting rights proxies in connection with proposed amendments to articles of organization. (Release No. 6351).

ROCHESTER GAS & ELECTRIC CORP.'s proposal to reclassify its preferred stock has been approved. The company proposes to reclassify its outstanding 120,000 shares of 6 percent and 40,000 shares of 5 percent preferred into 160,000 shares of 4 percent preferred, and in connection therewith to retire 40,000 shares of the reclassified stock. The Commission directed that, except in accordance with an order of the commission, Rochester shall pay no dividends on its common stock except out of earnings applicable to such stock accumulated subsequent to December 31, 1944, after first deducting therefrom $200,000 equivalent to the call premium on the 40,000 shares of preferred to be retired, plus expenses of the transaction. (Release No. 6340).

ASSOCIATED ELECTRIC CO. and its subsidiaries' joint application-declaration concerned with proposed transactions involved in carrying out the settlement of various claims against the former's parent companies, Associated Gas & Electric Co. and Associated Gas & Electric Corp., has been approved. The proposed transactions include: (1) The issuance and delivery by General Public Utilities Corp., the surviving company under the reorganization plan of Ageco and and Agecorp. of 107,000 shares of its common stock to be acquired by Associated Electric and pledged with Guaranty Trust Co. as trustee under the indenture securing Associated Electric's debentures; (2) The transfer and delivery by Agecorp. to, and cancellation by, Associated Electric of 250,000 shares of its outstanding common stock, and the reduction of Associated Electric's capital from $35,000,000 to $21,500,000; (3) The transfer by NY PA NJ Utilities Co., another Agecorp. and Ageco. subsidiary, of the entire 166,600 shares of common capital stock of its subsidiary, Pennsylvania Edison Co., to Agecorp and the transfer by Agecorp. of such shares to Associated Electric. In approving the transactions, the SEC found them necessary or appropriate to effectuate provisions of Section 11 (B) of the Holding Company Act. The commission reserved jurisdiction over the fees and expenses of Associated Electric and imposed the condition that if and when all or part of the 107,000 shares of common stock of General Public became a free asset of Associated Electric the latter shall divest itself of all interest, direct or indirect, in the security within a period of ninety days. The commission issued simultaneously an order approving an application filed jointly by Ageco. and Agecorp. for approval of a second post-effective amendment to their plan of reorganization. Under its terms, the text of a loan agreement will be changed so as to provide: (1). That the final maturity date of $6,000,000 of unsecured 1½ percent serial promissory notes will be Jan. 1, 1951, and (2) That such serial notes will state expressly that they are senior to the 4½ percent convertible debentures of General Public, issuable pursuant to the provisions of the plan. (Release No. 6349 and 6354).

Hearing Scheduled

JANUARY 23: Resumed hearings on the proposed consolidation of subsidiaries in the Long Island Lighting Co. system. Hearing originally scheduled for January 16.

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New Mexico System Sold

Southwestern Public Service Co., Roswell, N.M., was recently authorized by the Federal Power Commission to buy electric facilities at Santa Rosa, N.M., and vicinity at a cost of $115,000. The generating plant and distribution facilities, serving 433 customers, are about 100 miles from the nearest point on the Southwestern's system. The properties were acquired from Robert K. Johnston of Oklahoma City, Okla.

UTILITY REPORTS

	Net Income 1945	1944
*Arkansas Power & Light	$ 1,902,055	$1,978,373
†Birmingham Electric	1,220,957	1,485,159
*Electric Power & Light and subs	10,852,937	7,318,942
*Louisiana Power & Light	1,167,330	816,352
*Mississippi Power & Light	644,108	1,365,150
*Montana Power	4,003,112	4,114,429
†Pennsylvania Power & Light	5,043,007	5,554,846
†Tampa Electric	1,185,325	1,288,052
*Washington Water Power	2,255,365	2,367,924

*Twelve months ended October 31.
†Twelve months ended November 30.

$21,462,505 Contract Let for Davis Power Project

A 1946 initial move toward construction of Davis dam and power plant on the Colorado River, 34 miles west of Kingman, Ariz., was announced recently by the Bureau of Reclamation, with low bid for the contract from Utah Construction Co., San Francisco, at $21,462,505.

Entire estimated cost of the project is $47,000,000 for the building of the dam, spillway, power plant, and other appurtenant works at the dam, and $30,000,000 for the construction of a power transmission system that will be interconnected with the Boulder dam and Parker dam systems.

Designed mainly to generate electrical energy and to regulate the flow of the river, the dam will be the greatest undertaking of the Southwest since Boulder dam was built.

An open channel on the Arizona side will carry the flow of water around the dam while it is under construction, and will be retained permanently for flow to the power plant forebay and spillway. Water will flow to the power plant through five 22-ft. diameter penstocks connecting with the forebay.

Five 45,000-kw. units will furnish an installed capacity of 225,000 kw. for the power plant, and a 230-kv. switchyard will be located nearby.

According to E. A. Moritz, regional director, Davis dam will provide an increased supply of electrical energy necessary to meet agricultural and industrial expansion in the Southwest. Planned for completion by mid-1949, the project will be under direction of H. F. Bahmeier, Bureau of Reclamation construction engineer.

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P. P. D. Sues City to Revoke Free Power for November

When Grand Island, Neb., cancelled the November bills of the customers of its city light department, Consumers Public Power District went to court to compel the city to collect the bills. The district charged the cancellation was an act of "hostility" toward transfer of its properties in Grand Island to the city. Consumers and the city have been dickering for purchase by the city of Consumers' Grand Island properties.

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China Makes First Payment

The Chinese Government has paid the Bureau of Reclamation $250,000 on its $500,000 contract to draw up engineering plans and specifications for a vast water control project for China.

HOW

DESIGN · CONSTRUCT · OPERATE · MAINTAIN

Safety Guards For Energized Breakers

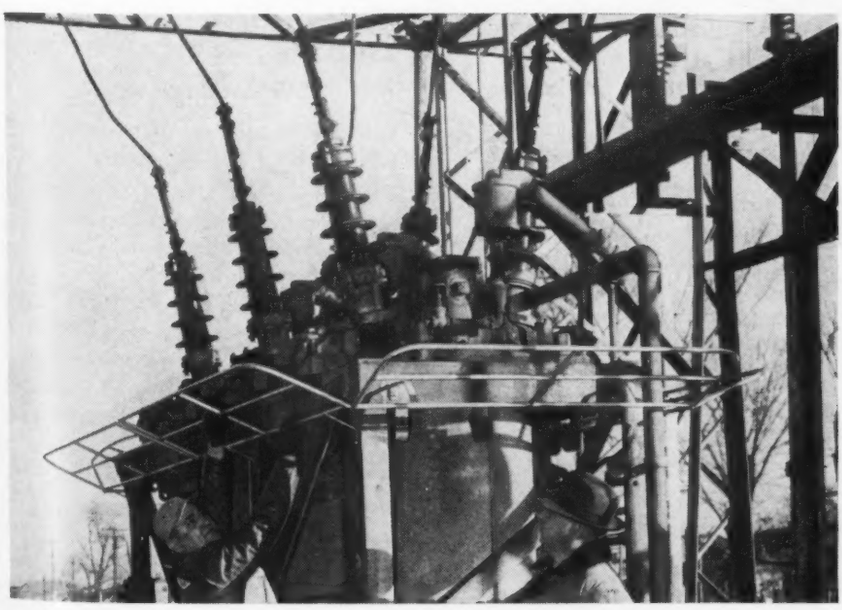
F. C. POHL
Superintendent of Substations
The Detroit Edison Co., Detroit, Mich.

Many of the fatal accidents in the power industry have resulted from men mistakenly attempting to work on the wrong equipment—equipment which was energized rather than that which was shut down and protected for them.

One of the ways in which the substation department of The Detroit Edison Co. is meeting this problem on its outdoor switch installations is by the provision of guards around each circuit breaker.

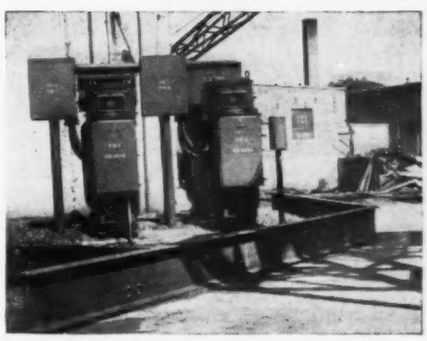
As in the illustration, the guards consist of a framework of light tubing welded into suitable sections and mounted in cleats on the breaker frame. They are kept in position on all operating and energized units, serving notice to all persons that the breaker is not to be touched. In addition to a simple and direct visual stimulus, they also act as a physical deterrent to climbing the breaker, putting a ladder against it, or possibly an extended reach by a workman.

The guard is removed from a breaker only *by the operator in charge of the station* and then only *after the unit has been shut down and red tagged* for the protection of workmen. The light weight of the guard and the construction of the attaching cleats permits easy removal and installation. No tools are required for either of these operations.



SAFETY GUARDS LIKE THESE mark energized outdoor circuit breakers on the Detroit Edison Co. system. The guards can be removed and installed without aid of tools

Guard Protects Feeder Regulators



I-BEAMS anchored into concrete roadway keep motor vehicles clear of outdoor bank; each beam braced at two points

To prevent a bank of induction regulators in the yard of a New England utility's steam plant from being brought into contact at any time with trucks or other motor vehicles moving through the adjoining roadway, a simple but effective guard was made up from two 20-ft. lengths of 15-in. I-beams along the border of the regulator section. These beams were attached by $\frac{5}{8}$-in. bolts to metal blocks fastened into the concrete roadway, and placed at an angle of about 30 deg. to each other to conform to the shape of the area allocated to the equipment. Each I-beam is braced at two points along its length by a 2-in. by $\frac{1}{2}$-in. flat steel bar which in turn is bolted into the concrete.

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Moth Balls Keep Bugs Out of Meters

GEORGE W. ROBINSON
Shreveport, Louisiana

Many old type electrical meters in grocery stores, cafes and other places of business have to be changed out

every year due to insects. If it were not for the insect invasion, these meters would not have to be changed out for a number of years. Some meters are changed out where the ants and roaches have eaten the felt gasket out, worked their way to the inside and stopped the disc from turning.

When an electrical meter is changed out, or a meter is being installed in a place suspected of roaches, the cover should be removed and two moth balls inserted under the cover. This obviously will keep ants, roaches and other insects out of the meter.

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Windlass for Raising Insulator Strings

To meet changed conditions imposed by southern California's new "industrial climate" it became necessary for Southern California Edison Co. to replace insulators on 14 miles of its 220-kv. Boulder transmission lines. The problem of hoisting the new insulator strings weighing 210 lb. to the top of 112,100-ft. towers was solved by D. D. Smith, of the company, with the windlass shown. This device, adapted from early California mining days, made it possible to do the work faster, easier, safer and with less men.

WINDLASS TEMPORARILY bolted to tower leg makes an easy job of hoisting 210-lb. insulator strings to top of 100-ft. towers on 220-kv. line

Fluorescent Phosphors Deposited Electrically

Daniel S. Gustin, manager of lamp engineering for the Westinghouse Lamp Division, Bloomfield, N. J., recently hit upon an idea for a new electrical technique of coating fluorescent tubes. Compared with ordinary methods, lamps thus coated electronically have about four percent better light-emission efficiency, the color of light is improved and production problems are simplified and speeded.

The result was accomplished by pulling a rounded, pencil-thick steel rod with a sharpened tip through the tube. This rod served as an electrode, introducing in the tube the high voltage necessary to force the particles of phosphors out of their suspension in air and precipitate them. As the rod was drawn along the tube interior the powder particles rushing into its sharpened point became ionized and positively charged. Immediately they were pulled by electrical attraction to the negatively charged, electrically conducting heated glass inner walls of the tube. Mr. Gustin explains that glass, while normally an excellent non-conductor of electricity, becomes a conductor when heated to 660 deg. F.

The force of the impact caused the phosphor particles to adhere to the glass wall where they released their charge. Instantly, the particles took on an insulating property, leaving only clear glass areas to attract more powder and assuring the even distribution of phosphors upon which depends top light-emission efficiency. Too thick a coating of phosphor particles, for example, is unsatisfactory because visible light is absorbed by layers underneath. Too thin a coating, on the other hand, wastes the ultraviolet and causes light inefficiency since there would be insufficient phosphor particles available for excitation.

All Westinghouse fluorescent lamps will finally be coated by this method.

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Distribution Staff Duties Summarized*

Safety Supervisor

This staff member is required to keep such safety records and conduct such safety inspections, tests, meetings, etc., as are specified by instructions of the company's superintendent of distribution from time to time. Attendance at safety or other meetings as directed by the latter officer is also a duty. A primary requirement is the investigation of accidents, the following up of cases of illness or absence from employment for other reasons when so directed, with report to the distribution superintendent. This supervisor acts as chairman of the company's distribution safety committee, the members of which are named by the superintendent, and it is the former's duty to call a meeting of this committee on the first Tuesday of every month, furnishing the superintendent of distribution with a copy of the minutes, and arranging to have a general group of employees present at each meeting. He makes up a schedule such that every employee in the distribution division shall as far as possible attend at least one safety committee meeting every four months.

The above supervisor records all miscellaneous safety work performed or unsafe practices noted, reporting these to the superintendent of distribution every Monday for the preceding week, or the next working day if Monday is a holiday. This report is intended to cover safety activities which otherwise would not be recorded and submitted.

Periodical Discussions

Discussion groups of two to five persons each in the same kind of work are assembled by the safety supervisor periodically to insure that every person in the division thus participates annually, as follows: January, cable splicers and helpers; February, meter service department, service estimator and assistants; March, meter department; April, operating department; May, appliance service department, carpenters and painters; June, stores department, repair department; July, office force; August, wiremen and garage men; September, general line

* One of a series of presentations covering the essential duties of officials of a public utility distribution division serving between 50,000 and 75,000 meters. Organization of the distribution department was outlined in ELECTRICAL WORLD, October 13, 1945, page 106.

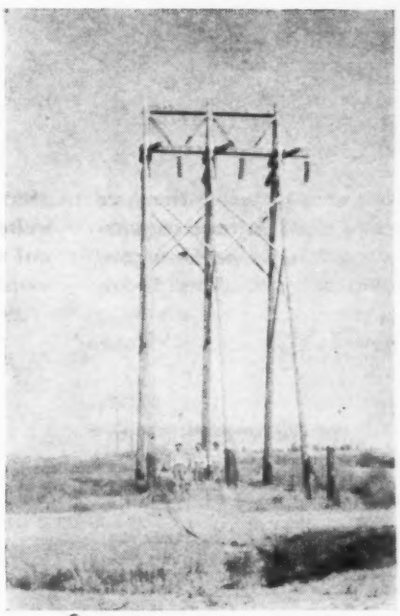
foremen, field inspector, emergency men, line crew A; October, line crew B, pole inspector and helper; November, line crew C, service connection crew; December, line crew D, cable crew, janitors.

The safety supervisor is responsible for an annual safety inspection of every employee in the distribution division; for the maintenance of a proper stock of first-aid supplies and equipment in the stock room (these being issued only on his order); and for the inspection during the first two weeks of January, March, etc., every two months of all first-aid kits in the division, with replacement of any missing materials. Another duty is to see to it that every person in the division (unless excused by the superintendent) practices the prone pressure method of resuscitation every month. The supervisor personally checks every gas mask in use or in stock during the first two weeks of February, May and October, and he is responsible for the monthly inspection of belts and safety straps, for the operation of a ladder inspection system, and for the conduct of a fire drill at the company's service building about May 1 and November 1 annually. He prepares a monthly schedule of safety meetings and inspections which are to be held in the general area under his supervision. He is also responsible for preparing reports in connection with certain local organizations and affiliated company interests on automobile accident prevention contests, industrial accident prevention, automobile and truck mileage and hours used, prone pressure practice, absenteeism, and of electrical accidents to employees or others.

• • •

Special Structure Eliminates Guys in Cultivated Fields

E. H. AIKEN*
Chief Electrical Engineer
Imperial Irrigation District, El Centro, Calif.

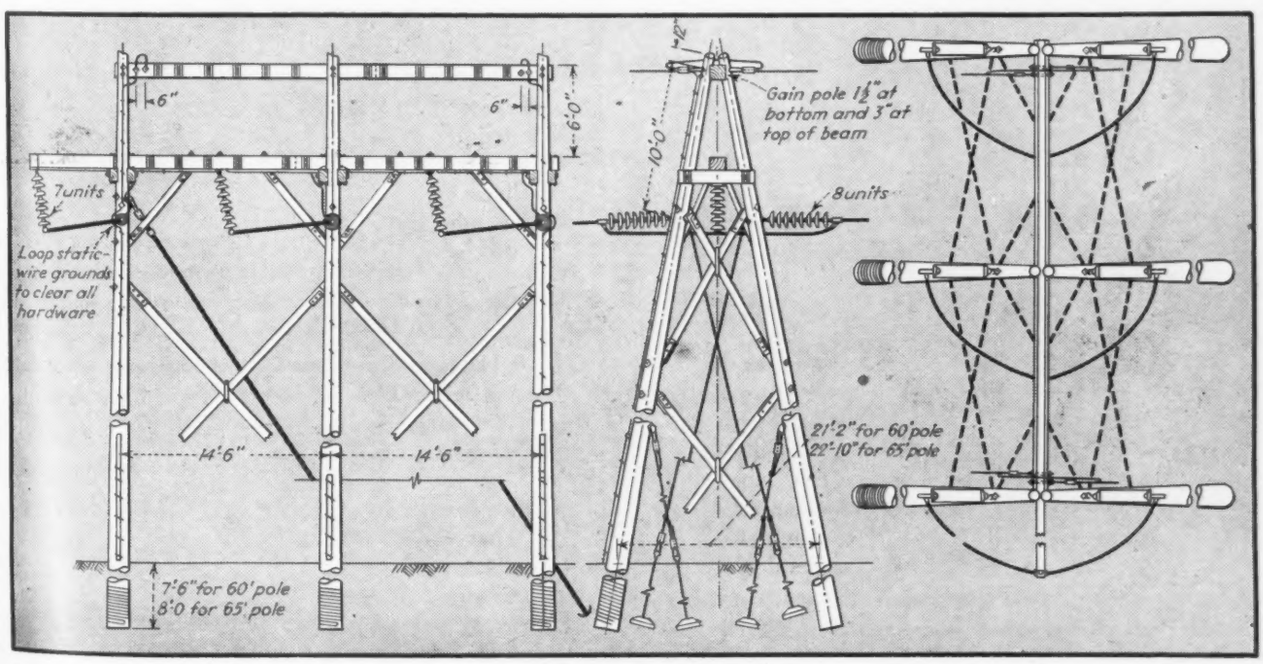


A-FRAME structure with Hughes Bros. X-braces and internal anchor guys to eliminate down guys external to the structure subject to damage from farm-structure and subject to damage from farming equipment, especially at night

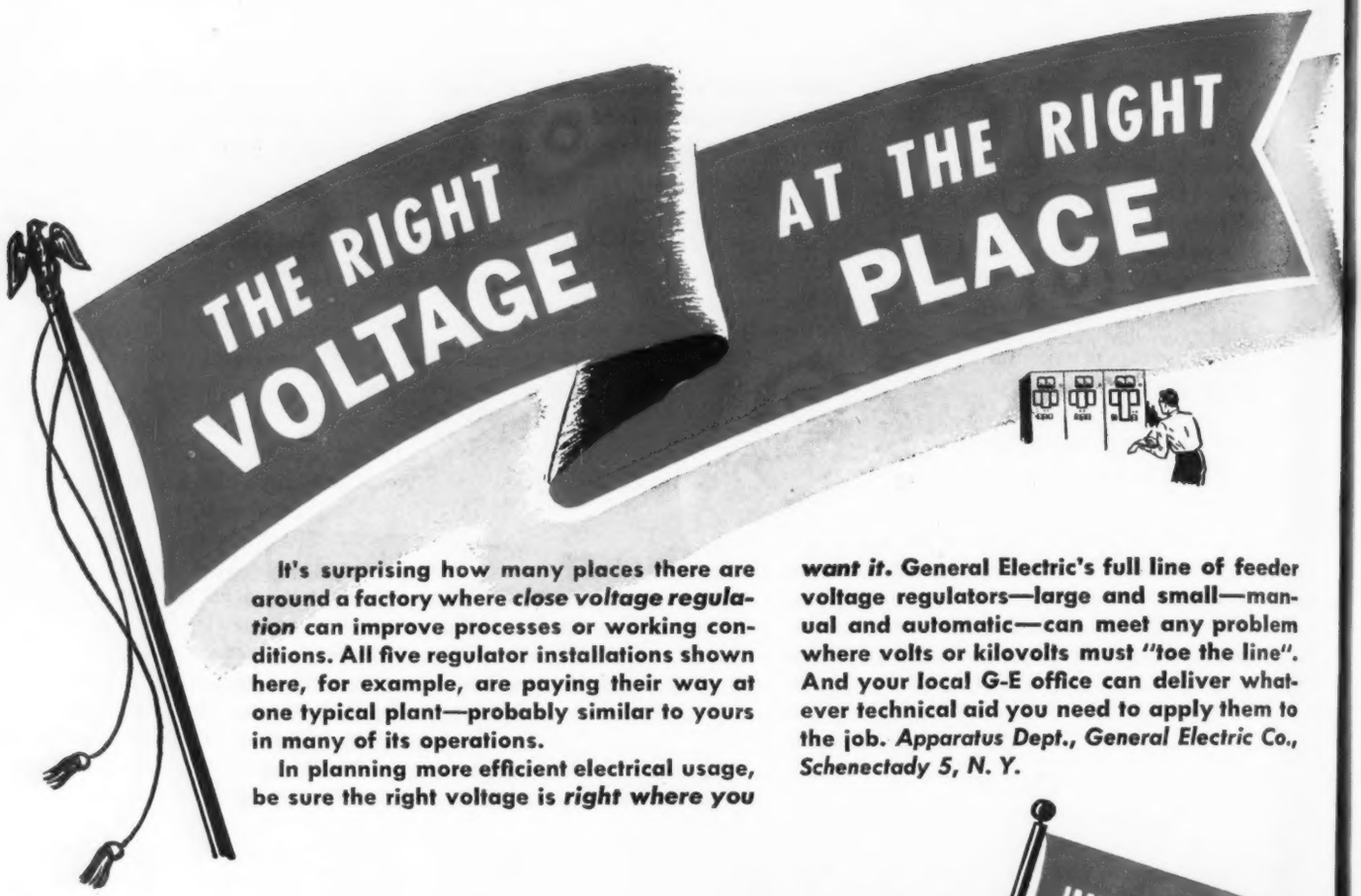
Where power lines traverse highly cultivated areas, such as the Imperial Valley, special attention must be given to down guys, or anchor guys. In building a new 92-kv. line the special structure illustrated was designed for locations where down guys could not be installed, or where, if installed, they would be subject to unusual hazards.

The major portion of this line runs through the irrigated area where intense cultivation is practiced. Much of the plowing and other farm work is done at night when visibility is poor, and with heavy equipment which is not the least impeded by any obstruction as light as a guy wire. As a result it is nothing short of wishful thinking to hope or expect a down guy to remain very long in a field. For that reason, the structure has both Hughes Bros.' X-braces and internal steel down guys which are quite well protected against farming operations.

* Now Service Shop Engineer, General Electric Co., Los Angeles.



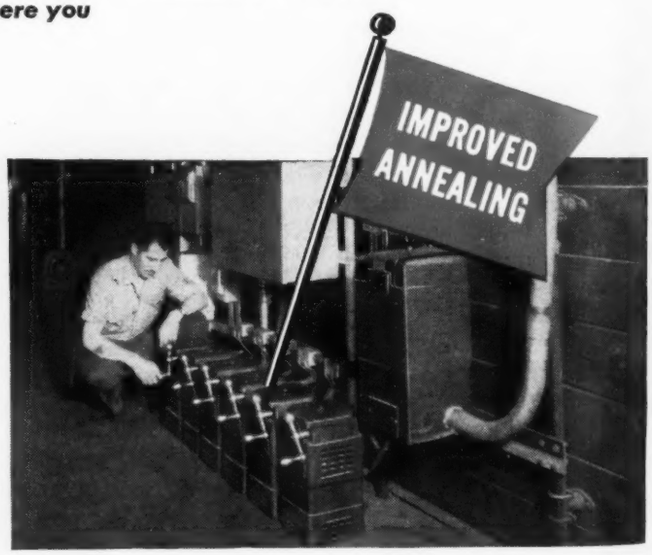
DETAILS OF SPECIAL STRUCTURE designed to eliminate external down guys



It's surprising how many places there are around a factory where *close voltage regulation* can improve processes or working conditions. All five regulator installations shown here, for example, are paying their way at one typical plant—probably similar to yours in many of its operations.

In planning more efficient electrical usage, be sure the right voltage is *right where you want it*. General Electric's full line of feeder voltage regulators—large and small—manual and automatic—can meet any problem where volts or kilovolts must "toe the line". And your local G-E office can deliver whatever technical aid you need to apply them to the job. *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

1 These dry-type induction voltage regulators are used to control temperature of a wire-annealing operation. Twelve strands are processed simultaneously, each regulator acting to control the current-flow through series-connected sections of two conductors. These hand-operated regulators make it easy to adjust for different conductor sizes and other changes in operating conditions.

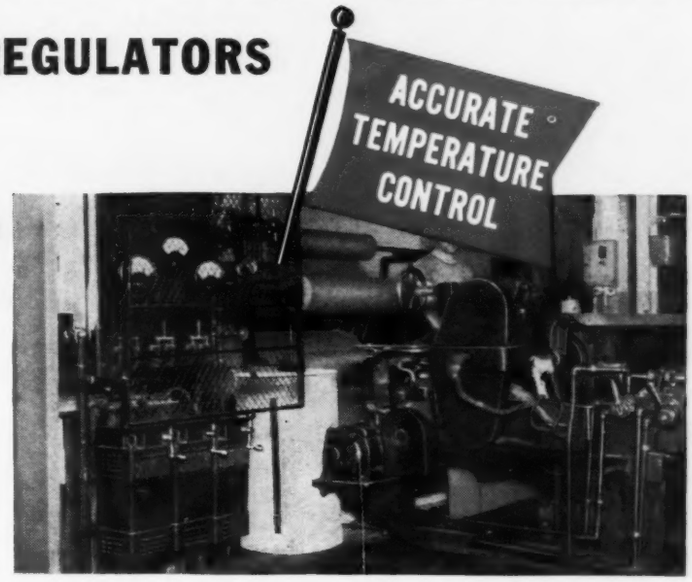


2 Smooth, stepless voltage control for 100,000-volt testing equipment is provided by this 5-kva dry-type induction voltage regulator. Connected in the primary (low-voltage) side of the step-up transformer, this regulator affords 100 per cent raise-and-lower regulation, so that output test voltage can be varied from 0 to 100 kv, simply by turning the crank.

...PAYS OFF 5 WAYS AT A SINGLE PLANT

USING G-E VOLTAGE REGULATORS

3 Electric heating circuits on a hot-rolling press used to fabricate laminated plastic forms are maintained at the required temperature with induction voltage regulators. Circuits for two electrically heated rollers and one hot plate are separately controlled by the hand-operated regulators, giving close control of processing.



4 Automatic voltage regulation by means of this dry-type induction regulator has "paid off" in a more uniform level of illumination. The full visual value of every kw-hr is obtained with fewer lamp burn-outs from overvoltage. Production space is saved by locating the regulator on a platform along with the Pyranol* transformer which serves the lighting circuits.

*Trade-mark for General Electric's nonsludging insulating and cooling liquid that will not burn

5 This 48-kva Pyranol induction voltage regulator, installed in a basement substation, automatically maintains the proper voltage for lighting circuits in the plant office building. A Pyranol regulator was chosen for its safety in this confined indoor location.

For complete information on any of General Electric's voltage regulation equipment, write for the following publications:

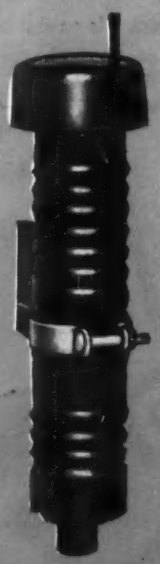
Oil-immersed Induction Voltage Regulators—Type IRS
GEA-2018 (24 kva and smaller)
GEA-2985 (36 kva and larger)
Pyranol Induction Voltage Regulators—Type IRS, GEA-3443
Dry-type Induction Voltage Regulators—Type AIRS, GEA-3057
Inductrols (Small Dry-type Induction Voltage Regulators) GEP-238
Automatic Voltage Stabilizers GEA-3634
Variable-voltage Autotransformers GEA-3635

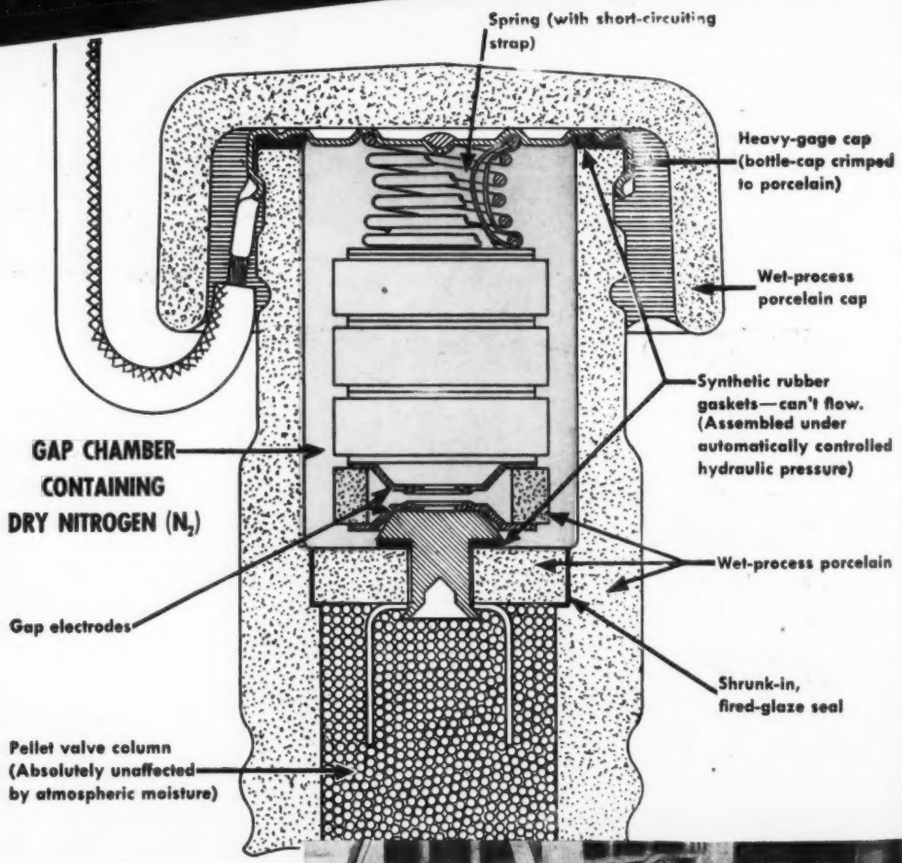
GENERAL ELECTRIC

404-38-5400

The G-E pellet arrester with new

The G-E pellet arrester is the only distribution lightning arrester that has a separately sealed gap chamber — the only construction adapted to N_2-treated series gaps




Spring (with short-circuiting strap)
Heavy-gage cap (bottle-cap crimped to porcelain)
Wet-process porcelain cap
Synthetic rubber gaskets—can't flow. (Assembled under automatically controlled hydraulic pressure)
GAP CHAMBER CONTAINING DRY NITROGEN (N_2)
Wet-process porcelain
Gap electrodes
Shrunk-in, fired-glaze seal
Pellet valve column (Absolutely unaffected by atmospheric moisture)

Sectional construction of 9-kv pellet arrester, typical of other ratings, showing separately sealed N_2-filled gap chamber containing series gaps.

A section, of the pellet arrester assembly line, showing the station for evacuating, vacuum testing, injecting nitrogen, and final sealing.

PELLET ARRESTERS

N_2-Filled gap chamber assures A NEW HIGH IN RELIABILITY

The *new* pellet arrester has these exclusive *CONSTRUCTION* features:

1. All air and atmospheric moisture (usually sealed in the arrester with *ordinary* manufacturing methods) are completely evacuated from the gap chamber.

This positively excludes the moisture of normal atmospheric humidity from the series gaps of the arrester, thus eliminating oxygen, the essential agent for ozone and all forms of oxidation, and eliminating the recognized adverse effects of internal condensation ("dewing") caused by changes in outdoor temperature.

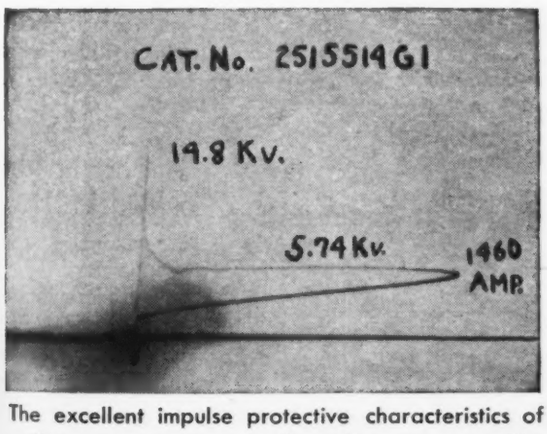
2. A vacuum test assures tightness of gasket seals.

The evacuation of air and moisture provides an error-proof, routine, vacuum-withstand test of the main sealing of each arrester. Thus, any unit having the slightest leak is detected and rejected.

3. Dry nitrogen (N_2) is injected into the gap chamber, and the small "treating" hole in the metal cap is immediately solder-sealed.

The injected dry-nitrogen permanently sealed in the gap chamber is *inert*. It prevents the formation of any ozone or oxides; keeps the gap electrodes bright as new during years of service operation, and gives more stable gap-sparkover characteristics.

The *new* pellet arrester—like its predecessor—is also distinguished by these outstanding *ELECTRICAL* characteristics:



The excellent impulse protective characteristics of pellet arresters *stay excellent*. Here is an oscillogram of a 3-kv pellet arrester *after 18 years of continuous service operation*. The arrester was manufactured in 1924.

1. Low impulse breakdown voltage to start discharge.

2. Exceptionally low IR drop, even at high discharge currents.

3. Large discharge capacity for severe lightning strokes.

4. Valve action; no exposed live parts or arc flame. Pellet arresters can be used on *any* part of *any* distribution system, rural or urban.

Ask for Bulletin GEA-2975 for complete information on G-E pellet arresters. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

Metrosil Material A Non-Linear Resistor

W. NEEDHAM
Electrical Research Engineer, Research Dept. Metropolitan-Vickers Electrical Co. Ltd. Manchester, England

A material which exhibits, in a consistent and controllable manner, a large increase in current when subjected to a small increase in voltage has been developed by Metropolitan-Vickers, Ltd. It is registered under the trade name of "Metrosil" as a "non-linear resistor."

It can be produced in quantity to a wide range of characteristics, the precise specification in each case being determined by the application under consideration. The characteristic may be such that by doubling the voltage applied across the Metrosil element the current is increased at least twenty-fold. This property is due to the presence of silicon carbide and is affected by the process of manufacture. The carbide material is embodied in a clay bond, moulded into disk or rod form and subsequently fired under exactly controlled conditions. Electrical contact is provided for by metal-spraying the surfaces which are to serve and act as electrodes.

Relation between current and voltage in a Metrosil unit is expressed by the formula $V = KI^b$, where V and I are the potential and current respectively between the sprayed surfaces, and both K and b are constants. K is usually about 2,000 per inch thickness and per square inch cross section, and b is 0.20 to 0.25.

The characteristics of the material suggest its use as a safety device to dissipate a surge voltage by allowing a current to leak through under the abnormal condition. On returning to the normal voltage the Metrosil resumes its function as a high resistance ready for dealing with the next surge.

Some applications are:

1. Used as a shunt across contacts of breakers in highly inductive circuits.
2. Control sparking at contacts on relays.
3. By-pass a sudden increase in voltage (a fault) on electronic equipment.
4. Serve as a lightning arrester.
5. In combination with a resistor, to improve sensitivity of relays or close voltage regulation of a d.c. supply.

Factors to be considered in determining the specification of Metrosil are:

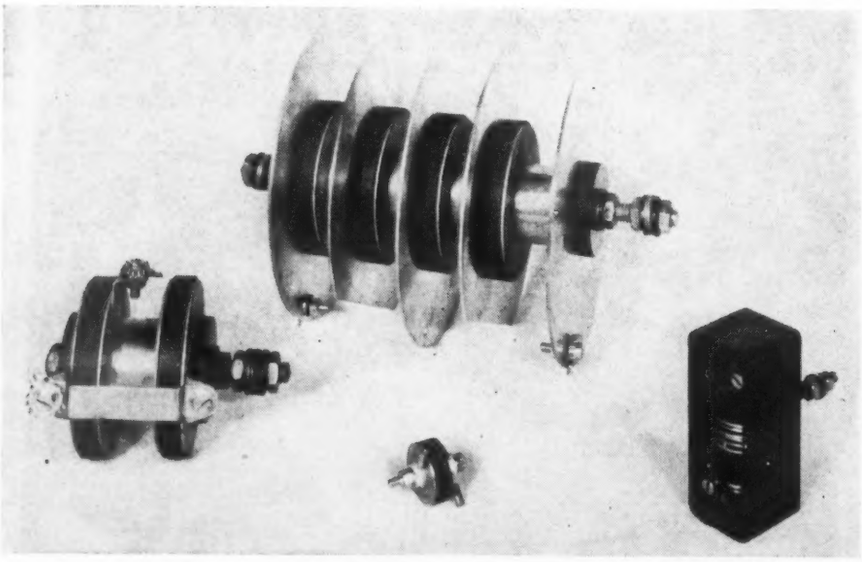
1. Size of disk, often dictated by space available.
2. Heat dissipated by the continuous application of the normal line voltage.
3. Heat dissipated by the liberation of inductive energy during the operating period.
4. Ambient temperature.

Regarding temperature coefficient for Metrosil, the resistance decreases (consequently the current rises) as the temperature is increased. At a specified voltage, a rise in temperature of 100 deg. C. produces an increase in current of approximately 60 percent.

Standard sizes of Metrosil disks range from $\frac{3}{4}$ in. to $3\frac{1}{2}$ in. diameter, with and without concentric holes. Minimum thickness of disk is about 0.30 in. This is a manufacturing limitation, but it also has a further significance. In order to obtain at least a fourth power law for the voltage-current relationship, the stress on a disk should be 500 volts per inch or more. This means that the voltage for the thinnest disk should be at least 15 volts to be able to take advantage of the Metrosil characteristic.

Characteristics of Some Metrosil Annular Disks

Operating voltage d.c. max.	Diameter, in.	Thickness, in.	Watts generated at operating voltage, max.	Margin of dissipation available for frequent surges, watts	Maximum energy permissible in single surge watts
250	1	0.3±0.1	2	...	1,000
500	1	0.7±0.3	2	1/3	2,000
600	1	0.85±0.3	2	1/2	2,500
250	3	0.35±0.1	4	4	5,000
600	3	0.75±0.25	4	6	10,000



EXAMPLES of mountings for Metrosil: (top) 3-in. annular disk assembly with 6-in. cooling fins; (left) 3-in. annular disk assembly with normal cooling fins; (center) 1 in. disk with ceramic insulation; (right) 1-in. disk with Bakelite housing

Mechanical Washer For Meter Motor Rotors

Cleaning and drying the synchronous motor rotors on M16, M20, M21 and IR30 demand meters is performed mechanically in the Bradford meter shop of Pennsylvania Electric Co. Eight units are processed simultaneously and require approximately the same length of time previously required for each unit manually cleaned.

Washer agitation action is provided by an obsolete Frigidaire compressor. The core of a loudspeaker is mounted on the compressor piston and oscillates vertically 400 times per minute. The drier action is provided by a centrifuge. It is direct connected to the motor shaft

SELF-SUPERVISION PLUS

NOW CONFIRMED BY 7 Years of Service

Ratings: Low pressure, 10 to 40 kv; Medium pressure, 40 to 69 kv.

CABLE THAT SHOUTS WHEN IT'S HURT. Any break in the sheath of G-E gas-filled cable operates a pressure relay and sounds an alarm. Seven years of service experience has shown that practically all breaks can be located and repaired before service is interrupted. The pressure-regulating system has been proved simple and successful.

"FIRST AID" BUILT IN. Controlled internal pressure in gas-filled cable levels out the stress on the sheath. Should falling pressure signal a leak, service can often be maintained by valving additional gas into the system, preventing penetration of moisture or other damage until a time when repair is practical.

MORE POWER THROUGH ANY DUCT. Uniform gas pressure means more uniform quality of insulation, permitting less insulation than is required in solid-type cable. The result is a conductor of higher current-carrying capacity for the same over-all diameter, or a smaller over-all diameter for the same conductor size. In one important installation, this made it possible to use present ducts and yet meet the need for increased capacity.

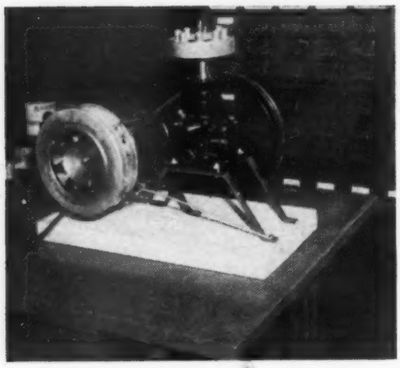
		GAS	SOLID
INSULATION THICKNESS (in inches)	15 Kv	.140	.203
	27 Kv	.240	.297
	40 Kv	.350	.422
OUTSIDE DIAMETER 3 Cond., 27 Kv		2.80	3.05

INSULATING COMPOUND CAN'T SLIDE DOWN HILL. Because little or no excess compound is present, there's no tendency for compound migration to strain the sheath at the bottom of grades or risers, or for insulation to dry out at the top. Gas pressure and insulation remain uniform. Successful installations include risers of more than 200 feet.

● Within its recommended voltage ranges, gas-filled cable offers the lowest long-term over-all cost (installation plus maintenance). It handles higher emergency overloads with lower internal stresses than solid-type cable. For full information, ask for Bulletin GEA-3652. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GAS-FILLED CABLE

GENERAL ELECTRIC



"HOME-MADE" CLEANING and drying device is made of a compressor, a ¼-hp. motor and two loudspeaker cores which accommodate eight demand meter motor rotors. Motors are held in place by spring-copper clips

and rotates at 1,750 rpm. A hood is provided to catch the cleaning fluid thrown off by the centrifugal force.

This unit is an improvement over others previously publicized since both the washer and drier are powered by a single ¼-hp. motor instead of utilizing a separate motor for each. The complete unit is mounted on and screwed to a 2-in. wooden plank.

In cleaning, the motors are drained of old oil, filled with about 5 c.c. of cleaning fluid, and shaken in the oscillator for approximately five minutes. The motors are then dried in the centrifuge for approximately one minute.

To rinse, the motors are filled with about 5 c.c. of oil and again shaken in the oscillator for about five minutes. The motors are then drained and filled with 1.8 c.c. of new oil after which they are ready for service.

•

A Simple Test For Substandard Coal

R. W. GAUSMANN
Director of Research, Indianapolis Power & Light Co., Indianapolis, Ind.

A simple test has recently been encountered which apparently permits rapid detection of substandard coals with equal ease in the field and in the laboratory.

At infrequent intervals, analysis of a coal shipment reveals a below normal figure for ash-free, moisture-free heating value (H value). This is usually accompanied by a rather high moisture content. Such coals are usually called "crop coal." It is not certain whether this substandard state is due to weathering, or to incomplete coalification. Such coals at best cause a substantial increase in the consumer's fuel bill and at times may affect the load carrying capacity of the boilers.

Qualitative Check

The test for such coals is as follows: A few small pieces of the coal about the size of a pea are placed in a beaker and sufficient concentrated ammonium hydroxide added to cover the pieces of coal. Substandard coal causes a distinct brown color to develop in the ammonia solution, while normal coal develops no color except perhaps a turbid gray due to suspended coal particles. The test appears to be very sensitive, since in a washed coal, which normally has a very consistent H value, deficiencies of only 100 B.t.u. in H value cause a distinct brown color.

Experience with this test has been limited to a few strip mines in the Southern Indiana field. Since theory points to a reaction between the humic acids in the coal and the alkaline ammonia solution as a cause for the brown discoloration, it may be that the test would have general application to other mines and other coal fields.

The test as developed in the Indianapolis Power & Light Co. laboratory has only been used as a qualitative check. While a quantitative test might be based upon this reaction, it seems doubtful whether it would be much simpler than the usual calorimeter determination.

Such limited testing as has been done indicates that this test does not show up the drop in H value which is usually found in coal that has been stored in the open for several years.

•

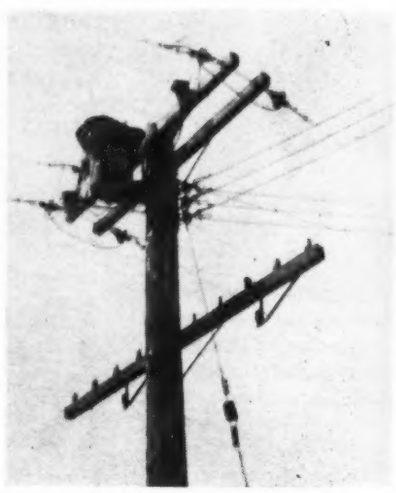
Metering Double Services From Street Pole Meter

Separate service drops to the farm house and to the barn necessitates a common metering point. On the Westfield, N. Y., municipal system, Supt. Harry Mettendorff provides for these by installing the meter on the pole at the street.

A 5-conductor No. 4 cable is used in this construction. Two of the five are connected between the transformer secondary and the line side of the meter, two between the load side of the meter and the "hot" wires on the secondary rack and one connects the transformer neutral, the meter neutral and the neutral on the top spool of the secondary rack.

The meter, which is installed at eye-level height, is always placed on the side of the pole away from the road. The service drops with this type of construction, which is used where load

TYPE CA, 15-amp., 240-volt, 3-wire meter is installed on off-road side



TYPICAL rural pole top utilizing separate service drop to house and barn. The 2400-volt primary is stepped down through a 7½-kva. transformer to 240 volts. Standard secondary rack is used for service drops. A 5-conductor No. 4 cable is used in meter connection down the pole, one wire being a neutral

concentrations may become heavy at either load center or where distance between house and barn is too great, are No. 4 stranded copper as minimum, and main fuses in both house and barn are 60 amp. The customer provides the grounds at each main fuse box.

Bigger Store Lighting Load is yours if you follow this New G-E Program!

IT'S READY NOW!

Be sure to ask your G-E Lamp representative to show you the new General Electric 1946 store lighting program, outlining your opportunity in this industry-wide campaign for higher standards of store lighting.

See all the material G-E has prepared for you —motion pictures in full color, sales training courses, a salesman's presentation, booklets, direct mail and many other sales aids. One hour invested in study of this program now will repay you with thousands of kilowatt hours in additional load.

See your G-E Lamp representative today. General Electric Lamp Department, Nela Park, Cleveland 12, Ohio.

G·E LAMPS

GENERAL ELECTRIC

Research is Always at Work to Improve G-E Lamps and Make Them **STAY BRIGHTER LONGER !**

HOW TO MOUNT LINE CAPACITORS

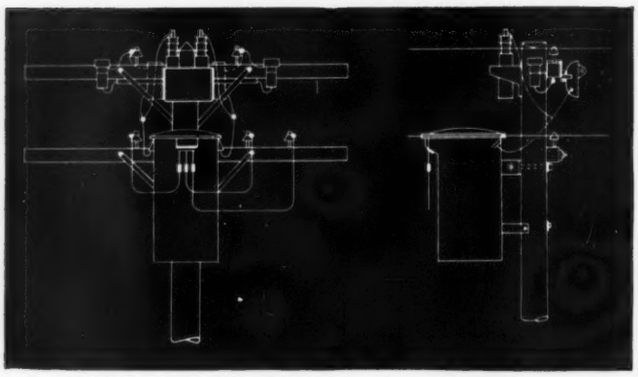


FIG. 1—15-kva., single-phase capacitor installation on 2,300-volt delta or 2,300/4,000-volt wye system

Methods of installing capacitors on single- and three-phase overhead lines, covering 15, 45 and 90-kva. installations. These methods are an adaptation from standards recently established by New England Power System, Boston, Mass.

The 15-kva. single-phase installation (Fig. 1) is made in connection with 7½ to 15-kva. transformer units on a common pole. In making this installation the existing primary arm through-bolt is replaced with a double arm space bolt. The transformer is lowered to provide 2 inches minimum clearance for a Westinghouse and 5 inches minimum for a G.E. capacitor. Neither the capacitor case nor the transformer tank is grounded or interconnected. If the capacitor is connected between phase and neutral wires of a 4-wire system, the cutout is omitted on the neutral. A 10-amp. fuse is provided for a 7½-kva. and a 15-amp. fuse for a 10 or a 15-kva. transformer.

The 45 kva., three-phase, 2,300-volt delta installation (Fig. 2) requires the capacitors to be placed at the first gain below the primary arm. It is not permissible to locate capacitors on junction poles or on the same pole with transformers, sectionalizing switches, cutouts or cable riser in the above case, nor can capacitor hangers or cases be grounded. Secondaries may be carried on middle or end pins on each side of the capacitor arm, and when on racks are transferred to these positions on capacitor poles. In fusing, 20-amp. type "N" links are used.

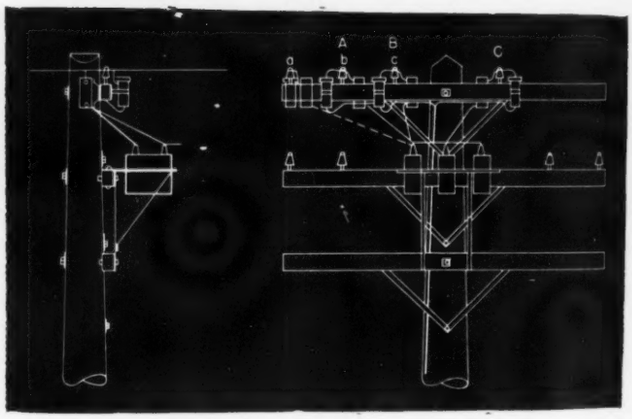


FIG. 2—45-kva., three-phase, 2,300-volt delta layout, includes three 15-kva. single-phase capacitors

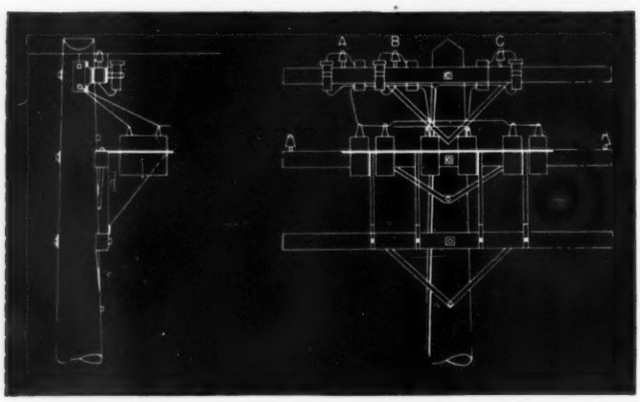


FIG. 3—90-kva., three-phase, 2,300-volt delta layout, where six 15-kva. capacitors are provided

In laying out a 90-kva., 2,300-volt, three-phase delta set-up (Fig. 3), six 15-kva. capacitors are placed on the first gain below the primary arm with the same isolation from equipment named in the 45-kva. case. Here series circuits may be carried on the end pins of the capacitor arm and secondaries on the capacitor kick arm. Type "N", 40-amp. fuse links are used.

SELECT
THE BEST RACEWAY
FOR THE JOB

General Electric Offers Two Types of Rigid Conduit . . G-E White and G-E Black . . to Safeguard Wiring

G-E WHITE PREVENTS ATMOSPHERIC CORRUSION

Where heat, cold, sunlight, condensation, rain and sleet will attack your wiring, SELECT G-E WHITE CONDUIT. The hot-dipped zinc coating on G-E White Conduit gives permanent protection to your wiring against extremes of weather.

For further information see the nearest G-E Merchandise Distributor or write to Section C166-9, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

G-E BLACK PREVENTS CHEMICAL CORROSION

Where chemical liquids, acids, fumes and oil will attack your wiring, SELECT G-E BLACK CONDUIT. The baked enamel coating on G-E Black Conduit gives permanent protection to your wiring against chemical corrosion.

General Electric provides a complete line of raceways—including rigid conduit, electrical metallic tubing, flexible conduit, Fiberduct, Q-Floor wiring accessories, and boxes and fittings designed to protect wiring.

GENERAL ELECTRIC

A METHOD FOR CATALOGING CONSTRUCTION MATERIALS

A system of listing materials developed to serve as a catalog of standard materials for distribution construction. Outline drawings aid identification of items. Illustration exemplifies a catalog page.

H. A. FRAZIER
Distribution Engineer, System Engineering Department, Virginia Electric and Power Co., Richmond, Va.

In the preparation of a catalog, each item of material is given careful consideration, is assigned a stock number, and a decision is made as to whether or not it is to be approved as a standard item and listed for purchase.

"Stock number" has the first four digits corresponding to the catalog section, the written specifications for the material and the standard materials drawing number. The next four digits with the decimal identifies the various items in its particular classification of materials.

"Approved material" (Appr. Matl.) listing indicates an item which is the approved standard and may be purchased for re-stocking.

"Description" carries all pertinent information needed for correct use of the material such as:—dimensions, type, voltage rating, strength, etc.

"Purchase data" column (here omitted) includes manufacturer's name and catalog number (only on approved items) and references for reordering and restocking of non-approved items.

"Outline" is a sketch of the item, enables catalog user to see at a glance what the item is.

The catalog is distributed throughout the system and is used principally by the stores department, the purchasing department, the distribution superintendents and distribution engineers.

Each catalog page carries at the top a materials subject (for this illustration—"Insulators, Porcelain and Glass"); in an upper corner is the catalog section number and page number for the respective section; in the opposite corner is the date.

STOCK NO.	APPR. MATL.	DESCRIPTION	OUTLINE
540418.00	Yes	Insulator, blue glass, pin type, 3¼ in. dia., 3⅞ in. high, 1 in. dia. pin hole, side groove; mechanical strength, 2,500 lb. Dry flashover 39.6 kv. Wet flashover 22.1 kv. For communications circuits only. Note: Stock No. 540425.00 can be used in place of this insulator.	
540418.01	Yes	Insulator, porcelain, pedestal, 69 kv., slotted cap, 3 in. B.C., 14 in. max. dia. petticoat, 14⅛ in. high, stack type. Characteristics for 2 units: bending strength; upright, 1,500 lb.; underhung, 2,000 lb. Dry flashover, 235 kv. Wet flashover, 180 kv.	
540419.00	No	Insulator, porcelain, pedestal, 69 kv., slotted cap, 3 in. B.C., 13⅛ in. max. dia. petticoat, 12⅛ in. high, stack type. Characteristics for 2 units: bending strength; upright, 1,500 lb.; underhung, 2,000 lb. Dry flashover, 225 kv. Wet flashover, 180 kv. Similar to O.B. 31549	
540419.02	No	Insulator, porcelain, pedestal, 115 kv., slotted cap, 5 in. B.C., 12 in. max. dia. petticoat, 9¾ in. high, stack type. Characteristics for 4 units: bending strength; upright, 675 lb.; underhung, 600 lb. Dry flashover, 350 kv. Wet flashover, 235 kv. Similar to Locke 8888-S	
540419.03	Yes	Insulator, porcelain, pedestal, 115 kv., slotted cap, 5 in. B.C., 17 in. max. dia. petticoat, 14⅛ in. high, stack type. Characteristics for 3 units: bending strength; upright, 1,700 lb.; underhung, 1,470 lb. Dry flashover, 385 kv. Wet flashover, 285 kv.	
540422.00	Yes	Insulator, porcelain, pedestal, 46 kv., slotted cap, 3 in. B.C., 14 in. max. dia. petticoat, 18 in. high. Bending strength, upright, 2,000 lb.; underhung, 1,000 lb. Dry flashover, 170 kv. Wet flashover, 125 kv.	

. . . SEE REVERE AT THE METAL SHOW CLEVELAND, FEBRUARY 4-8

AT the FIRST RECONVERSION SHOW be sure to see the Revere Exhibit. You will find it in Space B-306, the same location in which you found us in the two-previous Metal Shows.

Now we are able to point out, openly, definitely and in much more detail than ever before, the amazing advances in metallurgy born of war. In addition we shall re-emphasize the virtues of the more familiar Revere mill products.

Look for exhibits of Revere magnesium and aluminum, of the new specially-prepared switch copper, the new Free-Cutting Copper, the Certified Oxygen-Free High Conductivity Copper, the amazing special finishes available for Radar, and other products of copper, brass and bronze offering great peace-time potentialities.

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Revere Exhibit at the 1944 Metal Show

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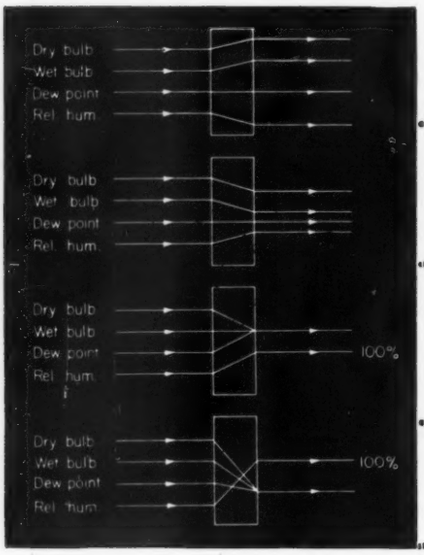
AIR CONDITIONING TERMINOLOGY, OBJECTIVES

AIR CHARACTERISTICS CHANGED BY AIR CONDITIONING



Heating—As air passes through a *heating* coil, the addition of heat raises both the dry bulb and wet bulb temperatures, while the dewpoint, since there is no moisture added, remains constant and the relative humidity decreases.

Cooling—Air flowing through a *cooling* coil has both the dry bulb and wet bulb lowered due to removal of heat, and assuming the coil surface to be above the dewpoint of the air, no moisture will be removed, thus maintaining a common dewpoint. With this type of operation, the relative humidity will rise.

Humidifying—As air passes through a *humidifier* using recirculating spray water to which no heat is added, the dry bulb will drop due to the evaporation of moisture into the air which absorbs sensible heat. The wet bulb will remain constant. The dewpoint of the air will be raised to become identical with the dry and wet bulb in the event of a 100 percent efficient humidifier, and the relative humidity will be increased to 100 per cent.

Dehumidifying—In a *dehumidifying* apparatus, using a cold surface or cold spray water for the dehumidification, the dry bulb, wet bulb and dewpoint are lowered to a common saturated temperature. The relative humidity is increased to 100 percent.

AIR CONDITIONING

Air conditioning is the process of simultaneously controlling the physical and chemical properties of the air in an enclosed space, or, popularly speaking, the temperature, humidity, cleanliness and motion of the air.

There are normally two phases to the process of air conditioning. The first, in winter, requires the addition of heat and moisture, while the second, in summer, entails the removal of excess heat and moisture from the air.

PSYCHROMETRICS

The first essential in the study of air conditioning involves an understanding of the psychrometrics—the units used in calculation, and the basic relationship governing the properties of air.

Clean air is composed of nitrogen, oxygen, water vapor, and small quantities of other gases, most of which are inert. Water vapor greatly influences comfort because its amount in the air reacts upon the body's heat loss control mechanism.

DEFINITIONS

Dry Bulb Temperature—The temperature as registered by an ordinary thermometer.

Specific Humidity—The weight of water vapor in grains per pound of dry air.

Wet Bulb Temperature—The temperature registered by a thermometer whose bulb is covered by a wetted wick and exposed to a current of rapidly moving air.

Dewpoint Temperature—The temperature to which air must be reduced to produce condensation of the moisture contained therein.

Vapor Pressure—The partial pressure exerted by the water vapor contained in the air, measured in inches of mercury.

Humidity—The moisture in the air in the form of vapor.

Absolute Humidity—The weight of water vapor per unit volume in grains per cubic foot.

Relative Humidity—The ratio of the actual vapor pressure in the air to the vapor pressure of saturated air of the same temperature.

Sensible Heat—Heat which added to or abstracted from a substance changes its temperature.

Latent Heat—Heat which added to or abstracted from a substance does not affect its temperature but changes its state. Specifically, in psychrometry, the latent heat of fusion, water to ice, $h_1 = 144$ B.t.u. per pound.

Total Heat—The summation of sensible and latent heat, B.t.u. per pound, of a substance between an arbitrary point, and the temperature and state under consideration.

PSYCHROMETRIC CHART

If any two of the properties of air for a given condition are known, that is, dry bulb temperature, wet bulb temperature, dewpoint temperature, or relative humidity—the other two may be found. Conversion of these quantities from one to another can be effected by reference to the psychrometric chart.

Adapted from notes of lecture prepared by Bertram B. Reilly, Dravo Corp., Pittsburgh, for presentation to industrial power salesmen of Duquesne Light Co., Pittsburgh.

More Power for More Lines!

Expanded utility service, long retarded by the war, calls for substantially increased battery capacity for control and auxiliary power. In providing this specialized equipment, Philco Storage Battery engineers stand ready to serve you at every stage of planning, engineering and installation. Only Philco offers you control batteries specifically designed for modern full float service—the famous Philco Floté Batteries that eliminate low cells and materially reduce operating costs. Only Philco Floté Batteries are available in all types of glass, rubber and Vitrabloc jars. Write for latest specification data. Specify Philco. PHILCO CORPORATION, Storage Battery Division, Trenton 7, New Jersey.

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FOR 50 YEARS A LEADER IN STORAGE BATTERY DEVELOPMENT

Table Supplements Article

TABLE II—Nature and Function of Calculating Board Components

Type of Unit	Components of Unit	Function In Calculator Studies
Generator Unit	Phase-shirting transformer with three-phase primary, single-phase secondary and voltage adjusting transformer or induction regulator. Phase angle and magnitude of single-phase output voltage are independently adjustable. Secondary output of the combination is impressed on equivalent circuit. Provided with ammeter, voltmeter, wattmeter.	1. Represent generating stations (a) Division of load among stations represented by adjustment of phase shifter secondary with respect to primary. (b) Voltage adjustment (by taps) depicts excitation voltage changes, or terminal voltage depending on problem. 2. Represent phase-shifting transformers.
Special Reactance Unit	Low-resistance reactors	Represent internal impedance of stations. Have sufficient range to represent subtransient or synchronous reactance of generators.
Line Unit	Resistors and reactors (adjustable) in series.	1. Represent impedance of transmission lines. 2. Simulate impedance of transformers. 3. Show impedance of other types of apparatus such as current limiting reactor, etc.
Load Unit	Resistors and reactors of wider range than in line units to represent loads properly. These resistors and reactors can be put in series or parallel. Since load taken by these units varies as square of voltage while load on actual system varies little with voltage, a tapped transformer or "load adjuster" is sometimes provided to hold load at desired value when voltage is changed.	Represent impedance of shunt loads.
Capacitance Unit	Adjustable capacitors	1. Represent an equivalent capacitance of long high-voltage transmission lines, underground cables, etc. 2. Represent static or synchronous condensers, negative reactance.
Autotransformer	Variable ratio autotransformers with low exciting current.	Represent ratio-changing transformers in closed loops of actual system.
Coupling Transformer Unit	Low-leakage mutual transformers	Represent mutual induction between parallel circuits.
Pi Line Unit	Adjustable resistor, reactor and two capacitors in a single unit connected as in "pi" circuit.	Represent long high voltage transmission lines instead of a combination of line and capacitor units.
Master Instruments	Ammeters, voltmeters, watt-var meters, phase angle meters and associated controls.	To determine electrical quantities in various circuit elements.

Referred to in the article "Today's Network Calculators Will Plan Tomorrow's Systems," on page 52 of the January 5, 1946, issue of ELECTRICAL WORLD, was a Table II relating to calculating board components. This table was inadvertently omitted. It is inserted here for the sake of completeness.

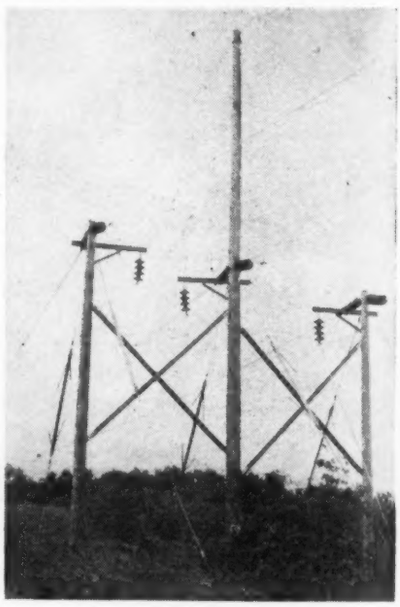
• • •

Conductors Dead-Ended at Different Levels

C. F. DOBSON
Electrical Engineer
Wisconsin Power & Light Co., Madison, Wis.

By dead-ending conductors at different levels on individual three-pole, long-span structures at a number of side-hill locations on its new 69-kv. Dodgeville-Prairie du Sac transmission line, Wisconsin Power & Light Co., Madison, was able to employ the minimum pole height that would maintain required ground clearance. The result was a notable economy in pole utilization.

It is apparent that if all conductors are carried on the same horizontal plane in side-hill structures, longer poles will be needed on the downhill side. In this case, however, since there was no clearance problem in mid-span, and ground clearance at the structure was maintained, no serious objection could be foreseen to bringing conductors in at different elevations. The difference in elevation of conductors at such side hill structure, then, is that of the slope of the ground. Outside poles of each three-pole structure were of equal length set the same depth. Length of the center pole, which carried the static wire, is determined by the shielding angle.



LONG-SPAN STRUCTURE (517) on side hill has conductors dead-ended at different levels permitting use of minimum pole height that will give ground clearance. X-Braces give sufficient lateral stability with guying to make crossarms unnecessary. Two 35-ft. poles and one 55 ft. are used here

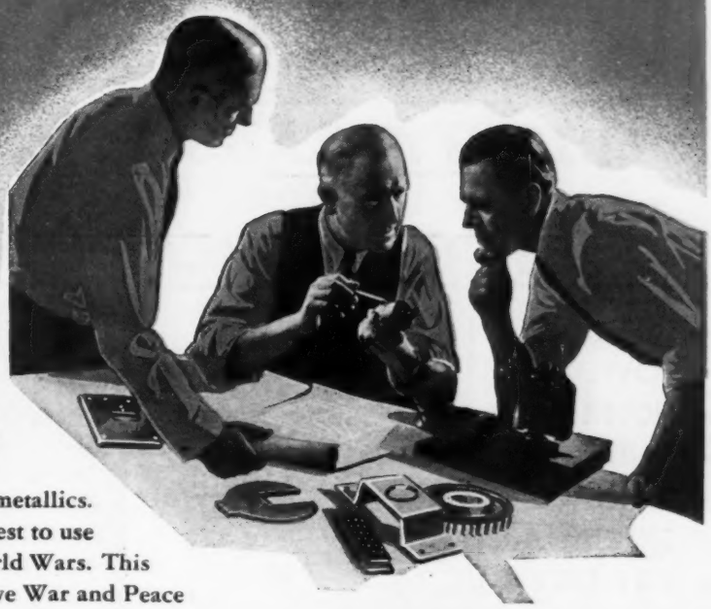
By far the majority of spans in this 42-mile line use the relatively new but familiar "Z" or "wishbone" type of single-pole structure with No. 1 cop-

Data on Selected Long Spans
69-Kv. Dodgeville-Prairie du Sac Line

	Structure No. 380	381	Structure No. 517	518	Structure No. 531	532
Ground Elevation at Structure—ft	169	294	529	513	660	619
Range of Ground Elevatian in Span—ft	169–165–294		529–414–513		660–526–619	
Span—ft	1352 River Crossing		878		878	
Conductor Size	134,600 ACSR		2/0 ACSR		2/0 ACSR	
Conductor Tension (Max. heavy load) %	50	6,460	50	2,672	50	2,672
—lb	2–60	2–40	2–35	2–40	2–50	2–40
Pole Sizes	1–75	1–65	1–55	1–65	1–70	1–65
Static Wire Size	134,000 ACSR		3 No. 8 Copperweld		3 No. 8 Copperweld	

NEW PROBLEMS?

C-D *has acquired the* KNOW-HOW *to help you apply* NON-metallics



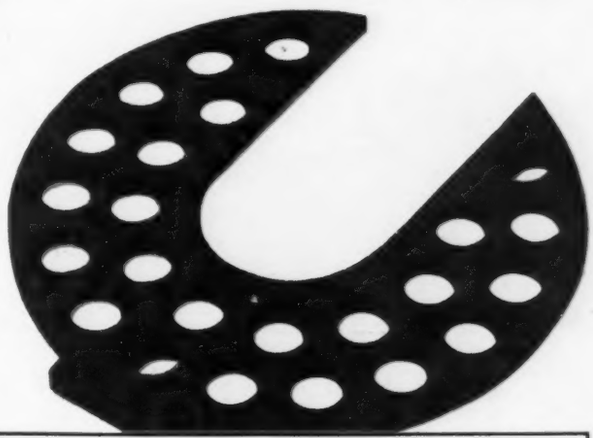
Save yourself time and worry . . . avoid the risk of using the wrong NON-metallic . . . by consulting with C-D technicians while your product or production plans are in the blue print stage.

Since 1895 C-D has been manufacturing NON-metallics. C-D's accumulation of KNOW HOW on where best to use NON-metallics, includes the problems of two World Wars. This knowledge and experience, gained in helping solve War and Peace problems of product performance and production efficiency, are available to help you solve your "What Material?" problems.

The part illustrated herewith is a DIAMOND Vulcanized FIBRE clutch brake part. It was designed to meet the mechanical and thermal problems involved in braking the transmission of a 10 ton Diesel Locomotive. The resilience, toughness and abrasion resistance of Vulcanized Fibre were fully utilized to successfully meet the design and performance requirements of this unit.

Avail yourself of the benefits of C-D experience and knowledge when they will do you the most good . . . while your products are on the drawing board . . . before you actually go into production.

Wire, phone or write the nearest C-D office, and a C-D technician will get on the job.



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DILECTO—Thermosetting Laminates.
CELORON—A Molded Phenolic.
DILECTENE—A Pure Resin Plastic Especially Suited to U-H-F Insulation.
HAVEG—Plastic Chemical Equipment, Pipe, Valves and Fittings.

The NON-Metallics

DIAMOND Vulcanized FIBRE
VULCOID—Resin Impregnated Vulcanized Fibre.
MICABOND—Built-Up Mica Electrical Insulation.

Standard and Special Forms

Available in Standard Sheets, Rods and Tubes; and Parts Fabricated, Formed or Molded to Specifications.

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Bulletin GF gives Comprehensive Data on all C-D Products. Individual Catalogs are also Available.

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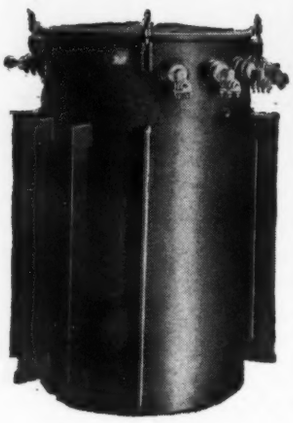
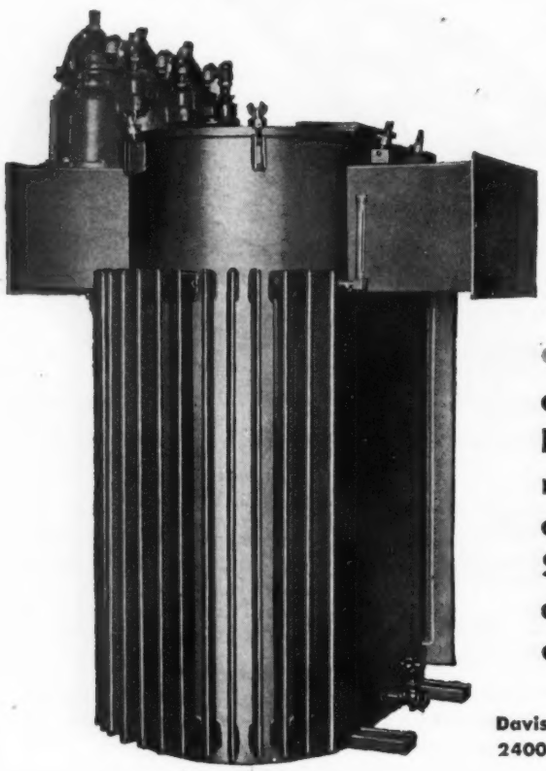


DAVIS 100 KVA, single phase, 2400-120/240 Volts Oil-cooled



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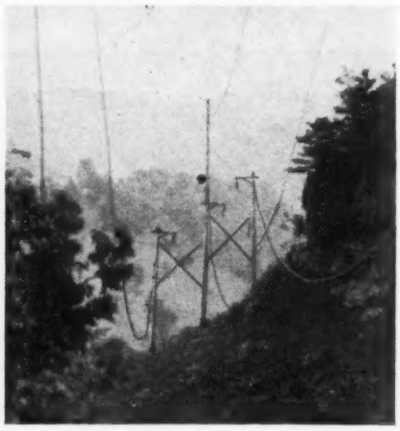
Manufacturers of Oil Cooled, Dry Type, Power and Distribution Transformers
Also All Types of Specialty Transformers Regardless of Size

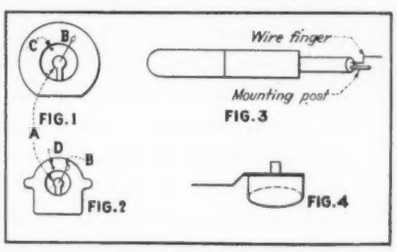
was carried around the pole on a short arm thereby saving considerable timber.

Construction of this line, which was completed in June, 1945, was by L. E. Myers Construction Co.



RUGGED TERRAIN prevented even tractor from reaching this structure (532) location. An existing tree stump was used as gin in raising poles

Torque Tester Usage Expanded by Adapter



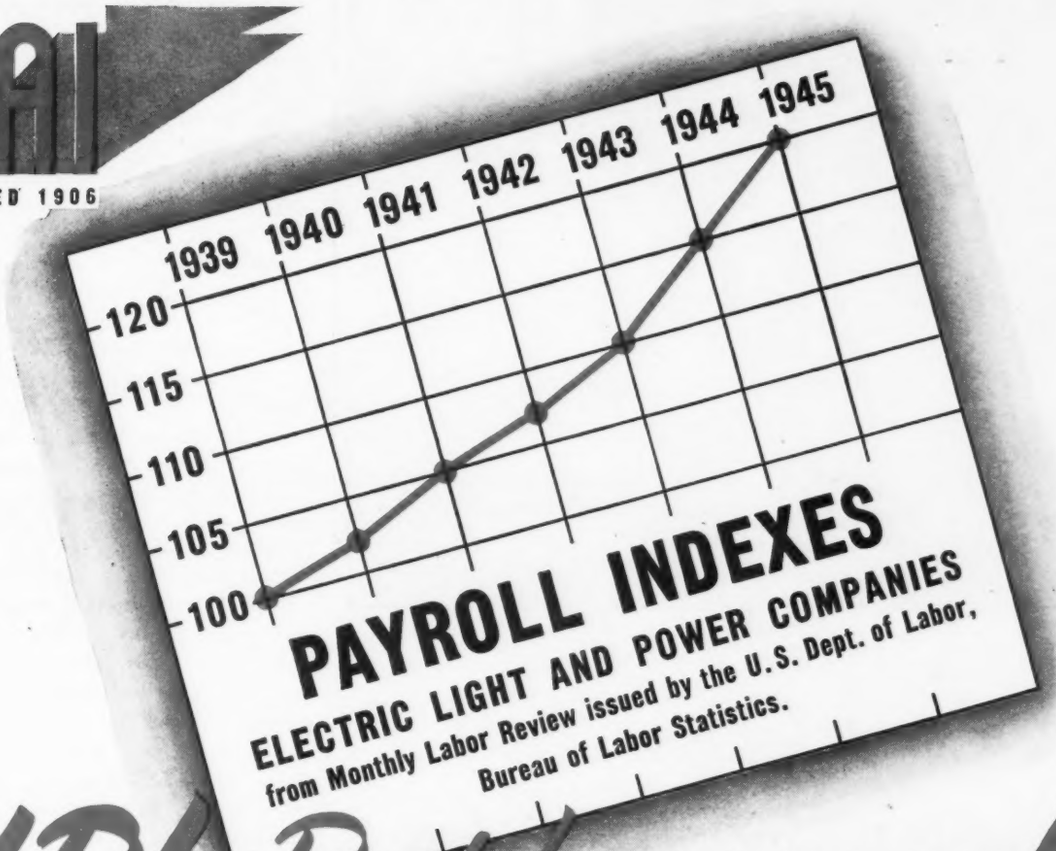
ADAPTER used with torque tester

Small "fountain pen size" torque testers have been successfully used on cumulative type demand registers for several years by the Philadelphia Electric Co. They were made to center over the pointer shaft so that the wire finger engaged the pointer within the cut-out area of the scale plate. Details for making and using the tester were previously reported in ELECTRICAL WORLD, October 31, 1942, page 114.

In later register designs a scale plate with a smaller cut-out area was used, which made it impossible to use the torque tester as originally designed. To overcome this difficulty Stanley B. Calhoon, of Philadelphia Electric Co.'s meter department, devised an adapter which makes it possible to use the torque tester with the old as well as

GAI

FOUNDED 1906



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Goes to work for you when your customers go to sleep

Here it is! The new G-E Automatic Blanket builds up your load in the darkest hours!

This "electrically-warm" Blanket works for you from midnight to morning—just when you need the load most. *Two* G-E Blankets equal one six-foot refrigerator in energy consumption.

Introduced by General Electric before the war, these wonder-Blankets are newly lightweight, warm, and soft—the marvelous result of tremendous wartime research and use.

Your customers have been reading about G-E Blankets for many months. In top-circulation magazines like *Life, Good Housekeeping, House Beautiful, Harper's, This Week,* and *Atlantic Monthly.*

And they've been hearing about G-E Blankets on the radio—via the lively new-idea show, "The G-E House Party."

Write us today for full information—find out how others are exploiting this new load "builder." Ask us for your copy of the promotion package, "G-E Automatic Blankets Are Here Again." General Electric Co., Appliance and Merchandise Dept., Bridgeport, Conn.

Automatic Blanket

"Goes to work when the lights go out"

GENERAL ELECTRIC

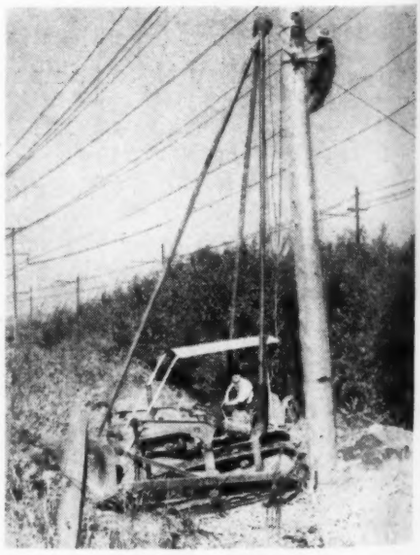
the new type scale plates on register.

This adapter consists of a brass section, cupped on the under side, and has a post formed on the upper side. A bronze strip is riveted to this brass section. In use the brass cup fits over the portion of the dial face which projects within the cut-out area of the scale plate. The bronze strip is anchored under the scale plate to hold the adapter in position. The torque tester when pressed against the post of the adapter allows the wire finger to clear the scale plate and engage the tip of the pointer.

In the illustration, the scale plate used on registers with cumulative disk is shown in Fig. 1 and the scale plate used on registers with cumulative pointers is shown in Fig. 2. Note cut-out area (A) is smaller on pointer type. (B) represents the pointer, and (C) denotes position of wire finger of the torque tester when it is placed in position on the cumulative disk type register scale plate. (D) indicates place where the wire finger would touch the scale plate on the pointer type register thus preventing proper functioning of torque tester without the use of an adapter shown in Fig. 4. Fig. 3 illustrates general form of the torque tester.

•

Tractor-Mounted Derrick



TRACTOR-MOUNTED DERRICK with bulldozer found to be a great labor saver by Puget Sound Power & Light Co. in both rural distribution and transmission line construction. Bulldozer blade proves invaluable for clearing and leveling, also provides rigidity for pole setting when it is lowered to the ground

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PAPER INSULATED CABLES

Probably high on your list of long-planned improvements in power distribution is the removal of overhead lines. Bringing them underground eliminates unsightly appearance, exposure to storms and other weather hazards. And *now* you can bring to the job the superior performance of Roebling Paper Insulated Cables.

Here is a "solid" Type Cable with high stress value that serves you well and economically in underground transmission or distribution circuits. Particularly preferred is the Shielded Type H, illustrated, adaptable for 3-phase grounded neutral circuits in the medium voltages. Usually drawn into conduits, it can also be installed directly into the earth with flat steel tape armor protecting the lead sheath.

But whether it's a standard Roebling power cable, or one designed to your own specifications, your requirements are met in stride by Roebling engineering, Roebling equipment, Roebling experience. Combined from first to last step of manufacture, they assure a finished product of safe, lasting serviceability.

We'll be happy to have a Roebling engineer go into the details of your cable modernization program with you. Why not check today with our nearest branch office?

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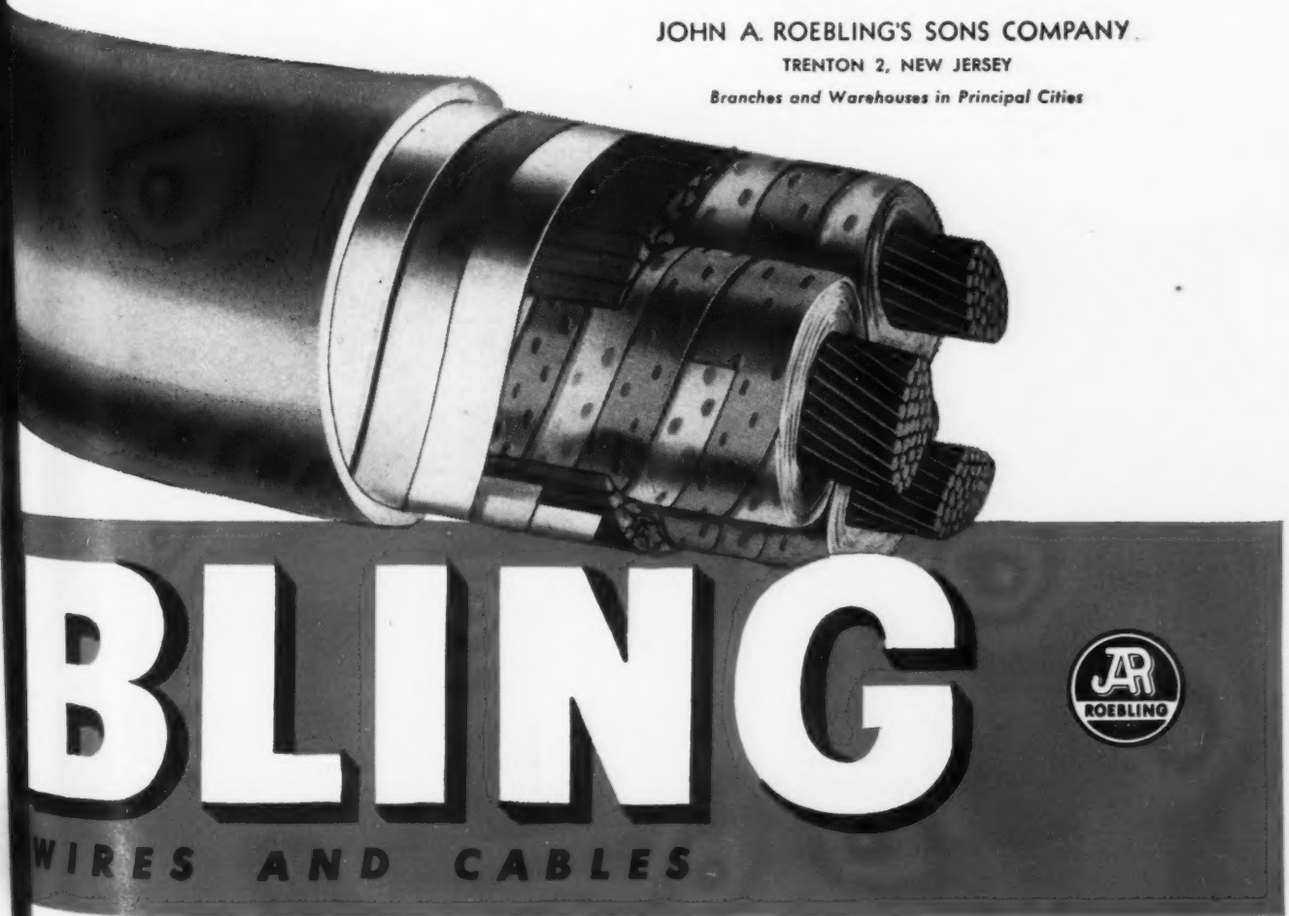

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WIRES AND CABLES

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Industrial

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Rural

Market Analysis Card For Industrial Survey

A. D. SPILLMAN
Supervisor, Market Studies and Applications Division, Philadelphia Electric Co.

An industrial plant survey was started by the Philadelphia Electric Co. in October of 1943. A survey card, illustrated, is being used in making the survey of approximately 2,500 selected major industries in the territory served by the utility.

As indicated by the card, the information recorded by the industrial engineer of the power company includes the various operations starting from the raw materials through to the finished product; a list of equipment and its age; a list of possible new equipment or processes; peace-time and war-time loads expressed in kilowatts, and expected percentage of war-time load that can be converted to normal operations. In addition to these various items a record is made of the date the business was established, its resources, source of power and fuel, and post-war plans.

With this recorded information it is possible to analyze a particular customer's operations, the changes that were brought about in his plant during the war, the percentage growth of his business ten years prior to the war, and his post-war plans. Provision is also made for the industrial engineer to record his personal observations.

All surveys completed by the industrial engineering divisions are sent to market studies and applications division where an analysis and tabulation is made to determine possible new applications and to prepare a report each month on the status of the cases surveyed, the kilowatt load involved, and the post-war load.

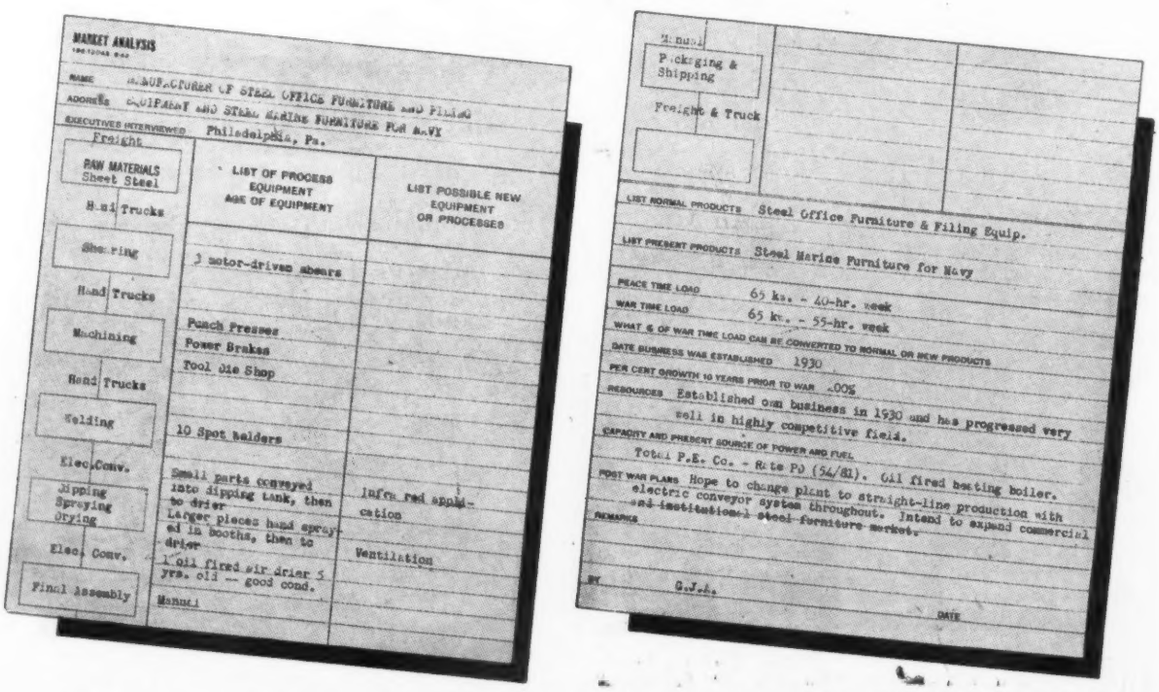
As of July 15, 1945, a total of 1,791 customer surveys were completed. This includes 1,463 industries and 328 apartment houses, commercial and special customers. In analyzing the 1,463 industries we found an increase of 19.1 percent in their kilowatt demand due to the war and that their plans for the post-war period result in a projected increase of 14.3 percent post-war load over pre-war load. The majority of the plants intend to carry out a program of modernization and to return to the manufacture of normal products. With this large sampling of the market we expect to be able to determine the attitude during the post-war period for the entire industrial market.

•

576-Kw. Spray-Process Powdered Milk Dryer

MARK M. CLAYTON
Industrial Engineer, Bonneville Power Administration, Portland, Ore.

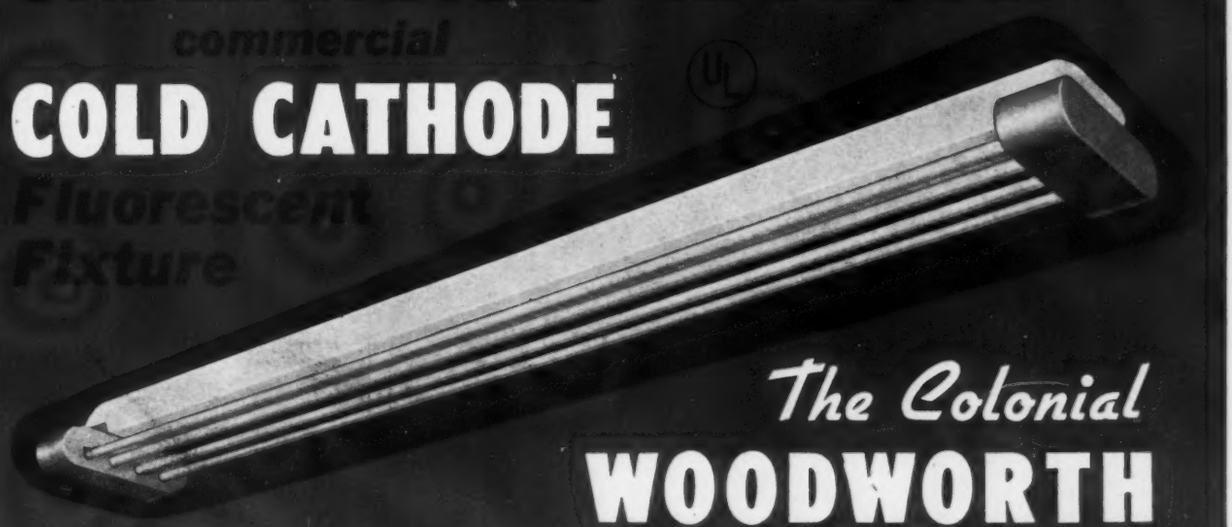
Development of a successful electrically heated spray process milk drier proved the solution to an expanded production program of the Farmers Co-operative Creamery Co. of McMinnville, Ore. The creamery was receiving more milk than it could process in its existing plant and the war had increased the demand for whole milk powder. Normally the heat required for operating spray-process driers is obtained from steam. Lacking boiler capacity to operate additional driers, the creamery investigated the possibility of applying electric heat to new drying equipment


MARKET ANALYSIS
NAME
ADDRESS
EXECUTIVES INTERVIEWED
Philadelphia, Pa.
Freight
RAW MATERIALS
Sheet Steel
Trucks
Shearing
Hand Trucks
Machining
Hand Trucks
Welding
Elec.Conv.
Dipping
Spraying
Drying
Elec. Conv.
Final Assembly
LIST OF PROCESS EQUIPMENT AGE OF EQUIPMENT
3 motor-driven shears
Punch Presses
Power Brakes
Tool die Shop
10 Spot Welders
Small parts conveyed into dipping tank, then to drier
Larger pieces hand sprayed in booths, then to drier
1 oil fired air drier 5 yrs. old — good cond.
Manual
LIST POSSIBLE NEW EQUIPMENT OR PROCESSES
Infra red application
Ventilation
Packaging & Shipping
Freight & Truck
LIST NORMAL PRODUCTS Steel Office Furniture & Filing Equip.
LIST PRESENT PRODUCTS Steel Marine Furniture for Navy
PEACE TIME LOAD 65 kw. - 40-hr. week
WAR TIME LOAD 65 kw. - 55-hr. week
WHAT % OF WAR TIME LOAD CAN BE CONVERTED TO NORMAL OR NEW PRODUCTS
DATE BUSINESS WAS ESTABLISHED 1930
PER CENT GROWTH 10 YEARS PRIOR TO WAR .00%
RESOURCES Established own business in 1930 and has progressed very well in highly competitive field.
CAPACITY AND PRESENT SOURCE OF POWER AND FUEL
Total P.E. Co. + Rate PD (54/81). Oil fired heating boiler.
POST WAR PLANS Hope to change plant to straight-line production with electric conveyor system throughout. Intend to expand commercial and institutional steel furniture market.
REMARKS
BY G.J.L.
DATE

FORM of 6 by 7-in. buff-colored card used in survey of industrial plants served by Philadelphia Electric Co.

Another COLONIAL First...

UNDERWRITERS' APPROVED commercial COLD CATHODE Fluorescent Fixture



The Colonial WOODWORTH

U. S. Pat. D-142126

Here is the fixture that the entire lighting industry has been waiting for. Already proved and accepted as the best kind of light ever developed, **Cold Cathode Fluorescent Lighting by Colonial** is the light source of tomorrow . . . ready today!

This beautifully streamlined, Underwriters' Approved **WOODWORTH** model embodies the latest advances in safety engineering so that it is impossible to come in contact with live parts.* It is available in two and four-lamp styles; for stem or ceiling mounting.

The four-lamp models are powered by two 900 volt, power factor corrected, transformers enclosed in the slender chassis of the fixture. Standard 93 inch 20 mm. 3500° K White lamps are used which operate independently of each other. **Total light emission is 8540 lumens at 196 watts (including transformer losses)—43 lumens per watt efficiency attested to by E.T.L. reports.**

The chassis is finished in baked enamel—white or ivory—with a selection of pastel shades on the end housings so that attractive color harmonies can be obtained to match interiors.

Now ready for immediate distribution through established jobbers. If your regular supplier cannot obtain the **WOODWORTH** write directly to **Colonial Lighting.**

8 ADVANTAGES OF COLONIAL COLD CATHODE LIGHTING

1. **Instant Starting**
2. **10,000 Hour Lamp Life**
3. **Low Operating Cost**
4. **Full Range of Colors including Soft White**
5. **Standard Lengths**
6. **Minimum Maintenance**
7. **Low Lamp Temperature**
8. **Underwriters' Approved**

ETL distribution curves and data now available on request

COLONIAL COLD CATHODE LIGHTING INSTALLATIONS ARE NOW SERVING

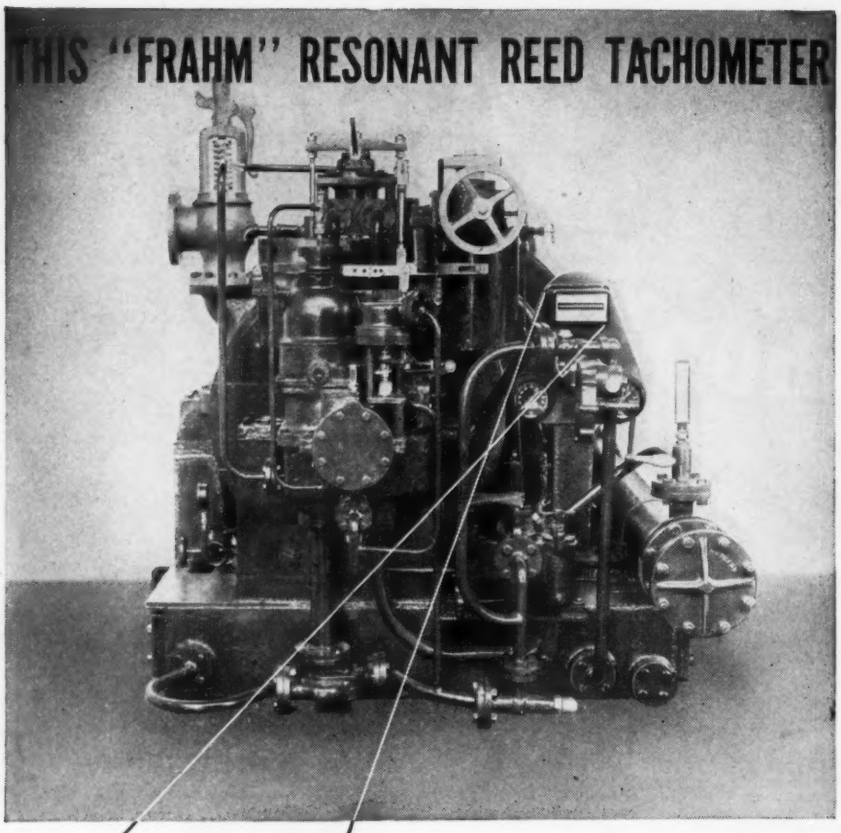
Chrysler Corporation • I.T.E. Circuit Breaker Co. • U.S. Marine Corps • Henry Disston & Sons, Inc. • Edw. G. Budd Mfg. Co. • Crown Cork & Seal Company • Wright Aeronautical Corp. • Western Electric Co. • Armstrong Rubber Co. • General Cable Corporation

*Patents Pending

COLONIAL Lighting

DIVISION OF COLONIAL NEON COMPANY, INC.

2001 TONNELLE AVENUE NORTH BERGEN, N. J.



. . . shows

Turbine speed

This is the turbine end of a 300 kw turbine-generator unit built by the Moore Steam Turbine Division of the Worthington Pump and Machinery Corporation. Mounted on the panel board to give a continuous indication of turbine speed is a Frahm Resonant Reed Tachometer.

Frahm Tachometers are chosen for this and many similar applications because of their extreme simplicity of construction and unfailing accuracy. Having no belts, shafts, gears, springs or delicate parts there is nothing to wear out, and they can be depended upon to function faithfully without attention—year after year after year.

Frahm Tachometers are supplied in both stationary and portable types, with various ranges available from 900 up to 60,000 r.p.m.

Write for Bulletins 1590-W and 1740-W. They give a complete description of the instruments and list all types and ranges commonly supplied.

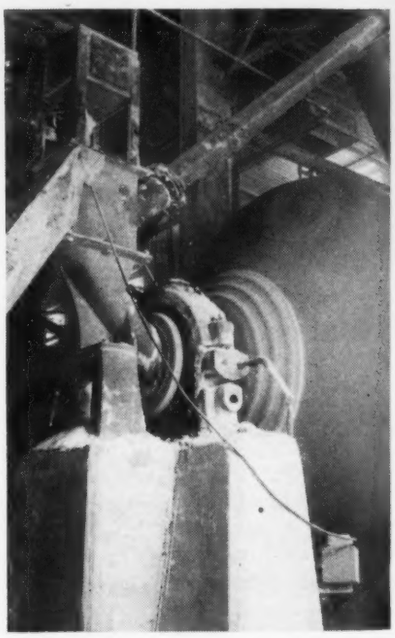
JAMES G. BIDDLE CO. • **1211-13 ARCH STREET PHILADELPHIA 7, PA.**

designed capacity of the drier was 500 lb. of powder per hour, it has been demonstrated that this production can be materially exceeded.

Automatic temperature controls and protective devices make the operation of the equipment practically fool-proof. Recording thermometers produce a continuous record of the operation and an alarm system warns the operator of any irregularities occurring in operating conditions. Power is purchased from McMinnville's municipal system, served from transmission lines of the Bonneville Power Administration. A diesel standby plant is maintained in constant readiness, thus assuring an uninterrupted power supply.

•

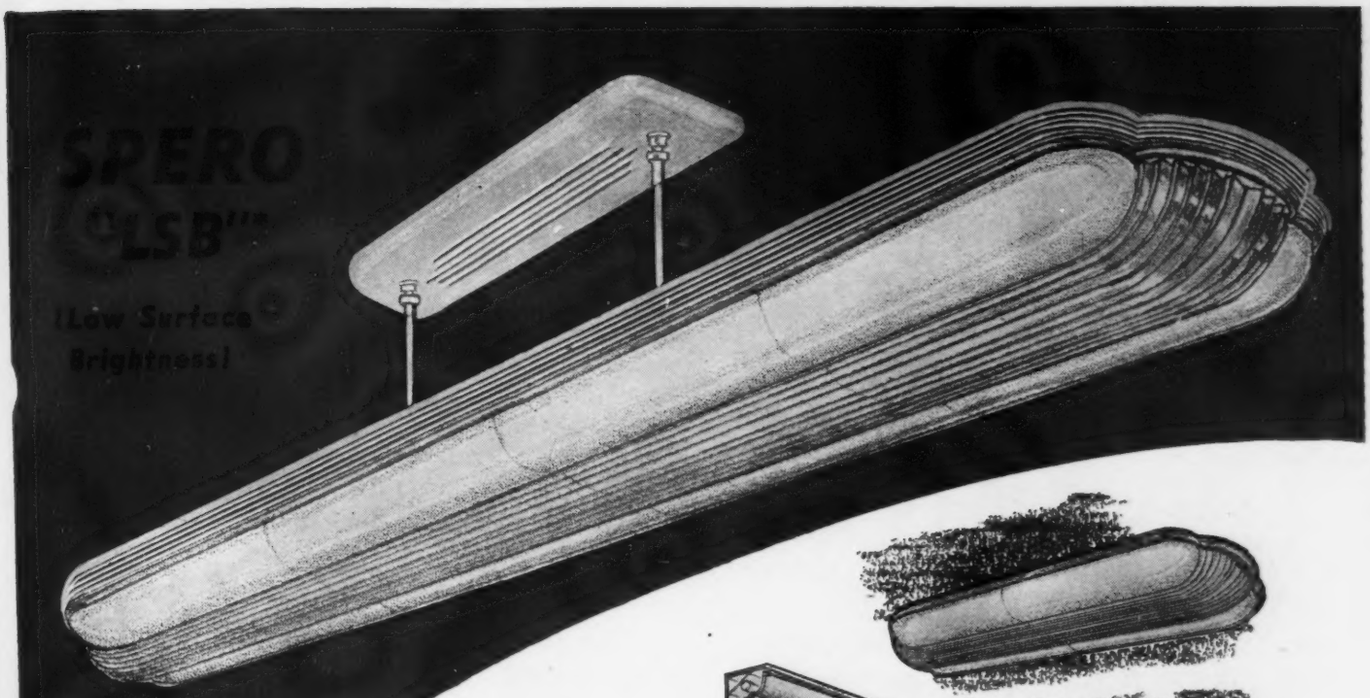
"Electric Ear" Controls Operation of Ball Mill



MICROPHONE (lower right) listens to sound of pebble mill and regulates sand input for optimum feed

Considerable increase in production and decrease in maintenance have resulted from replacement of the human ear by an electric one in the operation of a large pebble mill used by the American Nepheline Corp., Rochester, N. Y.

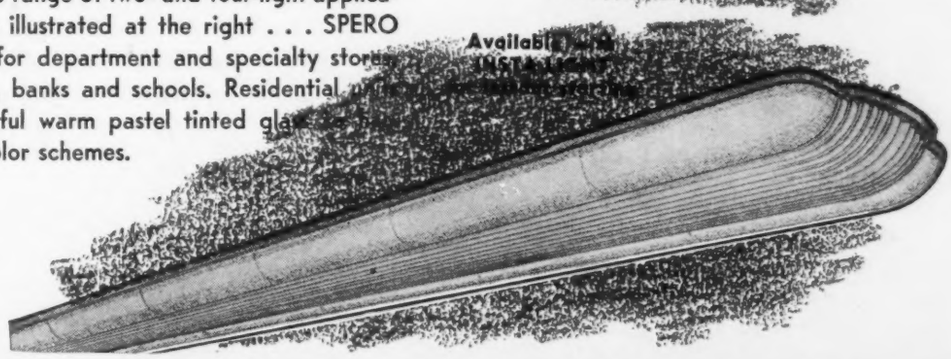
The mill produces powdered nepheline. It has a jasper lining and uses flint pebbles as grinders. Sand is fed in continuously through the trunnion at one end of the revolving cylinder and the powder is blown out at the other. If the feed is too fast the sand clogs the pebbles and production drops; if it is too slow the pebbles



ASS - SHIELDED FLUO ESCENT LUMINAIRES t created a sensation at the "Victory Lighting Jubilee"

Thousands at the recent exhibition in New York were impressed by the beauty, versatility, and effectiveness of the SPERO "LSB"* line of commercial and residential Fluorescent Luminaires.

Here is an entirely new application of architectural glass-ware, which brings fluorescent lighting into harmony with the most smartly appointed interior decorations. Ceramic-finish glass, with high transmission and low surface brightness, is molded in sections, permitting a wide range of two- and four-light applications, some of which are illustrated at the right . . . SPERO "LSB"* is ideally suited for department and specialty stores, lobbies, executive offices, banks and schools. Residential units are available with beautiful warm pastel tinted glass to harmonize with decorative color schemes.



Spero Engineers will cooperate with distributors, contractors or engineers in applying "LSB" to their projects.*

*Patent Pending.

WRITE FOR DESCRIPTIVE BULLETIN ON THIS A ND OTHER *SPERO* FLUORESCENT LUMINAIRES

THE SPERO ELECTRIC CORPORATION
18222 LANKEN AVE. ★ CLEVELAND, OHIO

Sparkling Clean HOT WATER "Packaged in Glass"

• • • IN PERMAGLAS,

sparkling blue, mirror-smooth glass-fused-to-steel!

SMITHway *Permaglas* Water Heaters heat and store water in a "glass package" that CANNOT rust or corrode—the single-piece glass lining proved in 23,000 test-years with waters from every state in the Union.

It is truly modern hot-water convenience, designed to match the comfort and efficiency of America's most modern homes... *hot water as sparkling clean as its source!*

There's Only ONE *PERMAGLAS*

SMITHway Permaglas GLASS-FUSED-TO-STEEL ...A GREAT AID TO SALES

SMITHway *Permaglas* Water Heaters give you the most powerful *new* sales story in the home-appliance business...

The single-piece, glass-lined heater tank. Sanitary as a sparkling drinkling glass. No tank-corrosion in the bath... no "tank spots" on clean laundry. Sparkling clean hot water as pure as the source itself.

Send for "The Inside Story of Permaglas." Address the A. O. Smith office nearest you.

HOT WATER BY wire

A.O. SMITHway

A. O. SMITH Corporation

NEW YORK 17 • PITTSBURGH 19 • CHICAGO 6 • TULSA 3 • HOUSTON 2 • DALLAS 1
LOS ANGELES 54 • SEATTLE 1 • INTERNATIONAL DIVISION: MILWAUKEE 1
In Canada: JOHN INGLIS CO., LIMITED

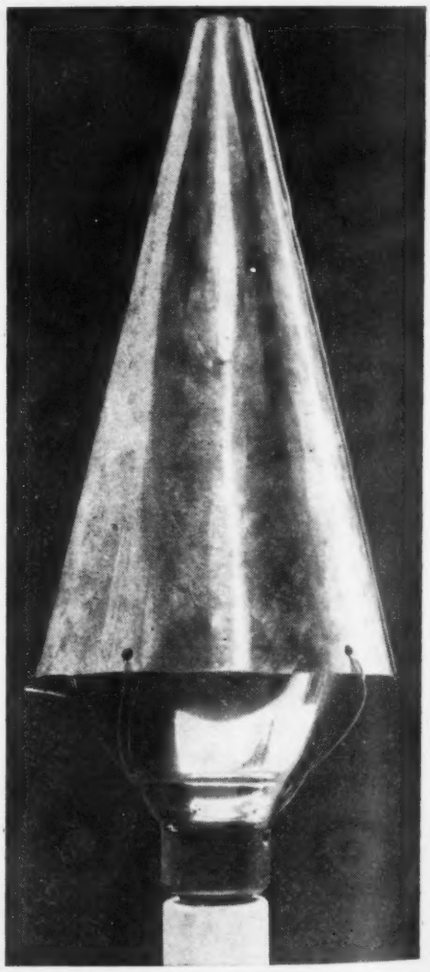
SMITHway Permaglas GLASS-FUSED-TO-STEEL ELECTRIC WATER HEATERS

and the lining are rapidly worn away. When the feed is just right production is maximum, maintenance minimum.

Previously, regulation of feed was manual; the operator's trained ear recognized the pitch of tone in the sound of the mill at which operation was most efficient. But no human ear can discriminate tones as accurately as can an electric one. A microphone was set up near the mill, its amplifier tuned exactly to the right pitch and connected through relay arrangement with the sand gate feeder. Now the slightest deviation from optimum sand flow into the mill is immediately and automatically corrected by adjustment to open or close the sand gate.

•

A Funnel For Light



A PIN POINT BEAM of "punch" light on elements of a window display is obtained with this home-made funnel scheme for irising a spot light, developed and widely used by the display department of the Consumers Power Co., Jackson, Mich. The illustration shows the funnel attached to a Par-38 150-watt outside spot light, wattage and type of lamp being found fitted to this lighting need

DON'T LET SLUDGE AND RUST RUIN YOUR TURBINE!

Fortified turbine oil, developed by Shell, prevents sludging and rust.

Shell scientists have developed a lubricating oil with the necessary oxidation stability to prevent sludging and—*at the same time*—prevent rust.

Shell Turbo Oil is the first turbine lubricating oil fortified to do these two important jobs.

The unusual oxidation stability of Shell Turbo Oil prevents the formation of sludge, prevents emulsion-forming products—makes it last longer.

And Shell Turbo Oil stops rust in its tracks because it clings tightly to the metal surfaces, keeping away oxygen and water. At the same time, this oil will not foam and has established a record of long service life.

Get the story from Shell Oil Company, Incorporated, 50 West 50th St., New York 20, New York; or 100 Bush St., San Francisco 6, California.

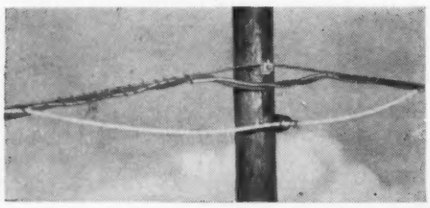
Shell Turbo Oil was the first of its type to be approved as meeting rigid U. S. Navy specifications.

SHELL

SHELL TURBO OIL

NEW EQUIPMENT

Aerial Cable

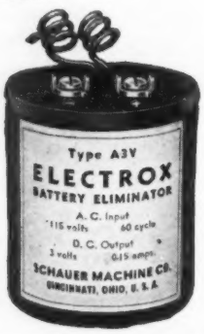


Self-supporting aerial cable: in standard sizes for potentials up to 10,000 volts. **Okonite Co.**, Passaic, N. J.

Aerial cable developed for hot line tapping. It is of "Dualay" construction—conductors are twisted first in one direction, secured by binder tape, and then twisted in the reverse direction. This allows conductors to be untwisted, separated and covered with rubber protectors. The conductor to be tapped hot is secured to the pole by a standard pin insulator.

•

Eliminator



Type "A3V" battery eliminator; housing 3 in. high and 2½ in. in diam.; **Electric Division, Schauer Machine Co.**, 2036 Reading Rd., Cincinnati 2, Ohio.

Copper oxide type rectifier for converting 115-volt, 60-cycle current to 3 volts d.c. output. It has a rating of 150 ma. and was designed to replace two dry cells in industrial and commercial applications.

•

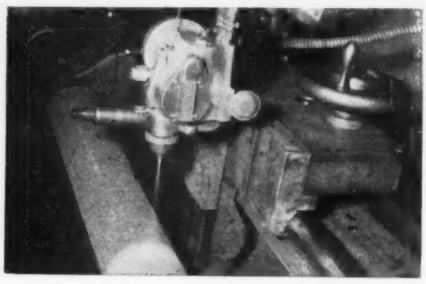
Fluorescent Fixture

"Tandemlamp" fluorescent fixture. **Doane Products Corp.**, Meriden, Conn.

Fixture uses an axial plane mounting of tubes and thereby places one lamp above the other. This arrangement is said to introduce a minimum of opaque surface into the path of reflected light and to block less of the reflected light. Small specular reflectors are used for control of light and for compactness of equipment. Sides are made in both opal plastics or metal. A louvered plastic sheet material, Louverplas, with parallel, translucent louvers separated by clear plastic spacings fixed in juxtaposition and traversed by minute prisms, is used at the bottom of the fixture for brightness control.

•

Metallizing Gun

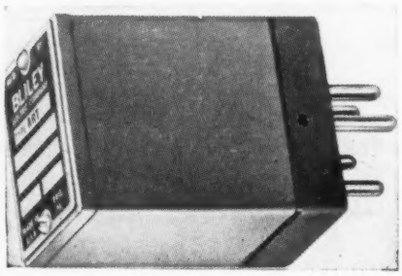


Type "Y" metallizing gun: uses 3/16-in. wire. **Metallizing Engineering Co., Inc.**, 38-14 30th St., Long Island City 1, N. Y.

Gun can be used for production and other heavy duty metallizing jobs. It is designed for mounted, mechanical operation, rather than for hand use. With a $\frac{3}{16}$-in. wire and 15 psi. acetylene pressure, it is reported to double previous spraying speeds.

•

Crystal Unit



Type "ART" crystal unit for VHF service. **Bliley Electric Co.**, Erie, Pa.

A temperature controlled crystal assembly designed for communication services where frequency stability must be maintained for temperatures ranging from minus 55 deg. C. to plus 75 deg. C. A built-in heater operating on 6.3 volts at 1 amp. provides the temperature control which is reported as within plus or minus 2 deg. C. This is said to permit an overall frequency tolerance within plus or minus 0.005 percent. The unit is available for any frequency between 3,500 kc. and 11,000 kc.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

•

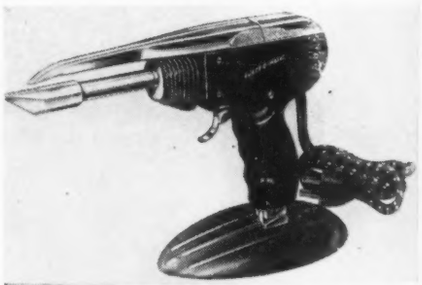
Timer

Electronic interval timer: Contacts rated 25 amp. at 32 v.d.c., 25 amp. at 125 v.a.c. and 10 amp at 230 v.a.c. **Electronic Controls, Inc.**, 44 Summer St., Newark 4, N. J.

Double receptacle permits timing two circuits in a range of from 1 to 120 seconds in increments of 1 second. Two dials are provided for time selection—one is calibrated in single seconds, the other in 10-second steps. Contacts are normal wired SPDT with double break but may be wired DPDT with correspondingly lower rating.

•

Soldering Iron



Eject-o-matic, automatic-feed electric soldering iron. **Multi-Products Tool Co.**, 123 Sussex Ave., Newark, N. J.

The iron is trigger operated and ejects a measured amount of solder from a reel concealed in the handle. This amount is regulated by a micrometer adjusting wheel mounted in the handle, and can be varied to the job needs. The iron is mounted on a special stand and can be tipped forward through an angle of 45 degrees.

•

Plastic Coating

Combined thermoplastic and thermosetting film: wt., 9.0 lb. per gallon; coverage 450 sq. ft. per gallon. **Baker Synthetics Inc.**, 51 East 42nd St., New York, N. Y.

A three coat application of the air-drying plastic is said to result in a film which prevents deterioration caused by electrolytic corrosion. The coats may be applied in one-hour intervals. Reported as applicable to towers, station structures, penstocks, gates,

Westinghouse finer fluorescents

Within the period from 1939 to 1946, Westinghouse Fluorescent Lamp prices have been reduced by two-thirds. Average rated lamp life is up 60%—in some cases 100%! The average efficiency (lumens per watt) has increased 40%. Altogether, improvements in Westinghouse Fluorescent Lamps add up to a light-per-dollar increase of 700%!

Today as always, Westinghouse buys the best raw materials obtainable . . . subjects the lamps to continuous and intensive testing and inspection all during manufacturing. Westinghouse research continues to explore means of building in further product improvements.

That's why the name "WESTINGHOUSE" on a Fluorescent Lamp package means you can count on getting the fullest benefit from years of experience, research and consequent product improvements.

That's why you can use, specify or sell Westinghouse Fluorescent Lamps with complete confidence of full satisfaction from every installation.

Westinghouse Electric Corporation, Lamp Division, Bloomfield, New Jersey

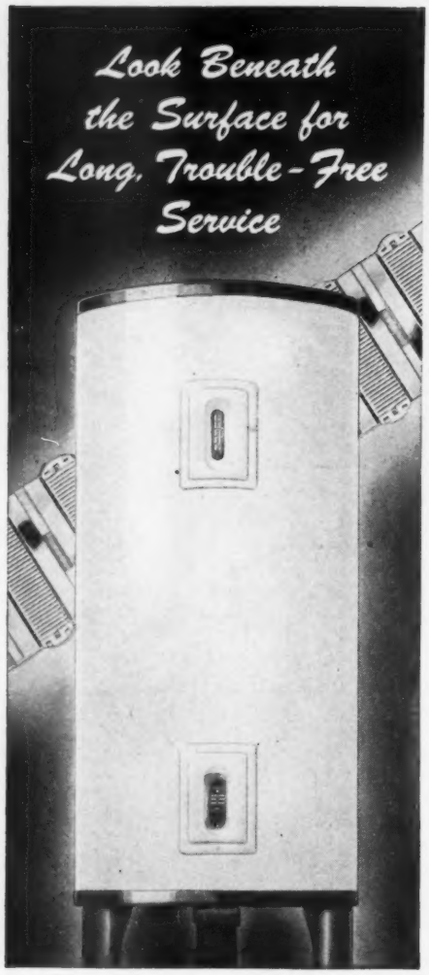
Westinghouse presents John Charles Thomas, Sunday, 2:30 P.M., E.S.T.—NBC.
Tune in Ted Malone, Monday through Friday, 11:45 A.M., E.S.T.—ABC.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

LAMPS FOR SEE-ABILITY

©1946, Westinghouse Electric Corporation



Just as you "cannot judge a book by its cover" neither can you predict the kind of service an electric water heater will give by its outer shell—it is what is underneath that counts. If you compare the inner construction of a Clark with that of other water heaters, you will find many little differences in material and design. But the big difference, the feature that guarantees long, faithful service is the famous Clark "Lifesaver" Element. If you are planning on merchandising electric water heaters you will find it well worth your while to get the facts about this time-tested feature found exclusively in the Clark. Our brochure "In a Nut Shell" is yours for the asking — may we send it to you?

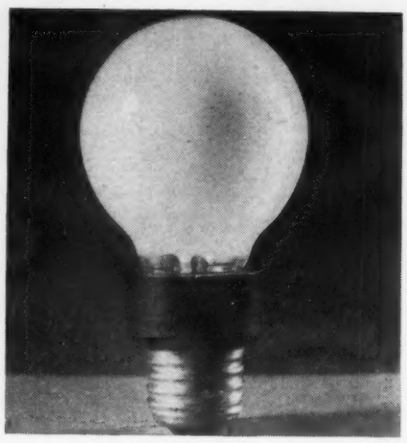
A CLARK FRANCHISE FOR YOUR TERRITORY
MAY STILL BE OPEN. WRITE FOR DETAILS

McGRAW ELECTRIC COMPANY
CLARK WATER HEATER DIVISION
5201 W. 65th ST., CHICAGO 38, ILL.

CLARK
ELECTRIC WATER HEATERS
A Toastmaster Product

etc. It is reported to adhere to practically all clean surfaces.

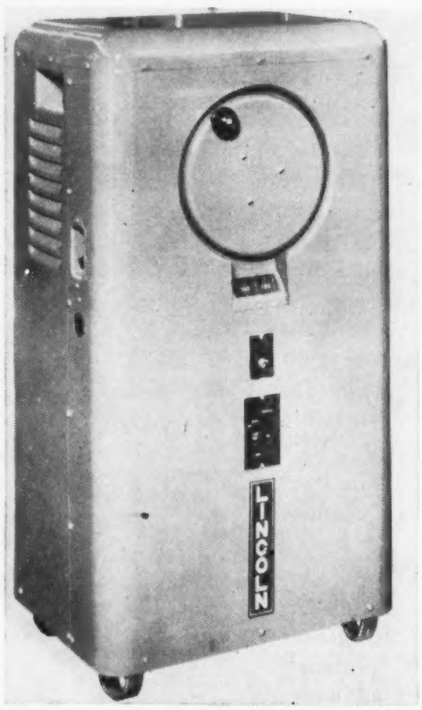
Lamp



Rubber-skirted lamp; 50 watt. **General Electric Co.**, Nela Park, Cleveland, Ohio.

Lamp has a rubber cushion base to absorb shocks and vibration. Except for the band of rubber around the neck of the bulb, the lamp resembles the conventional type. The report states that the lamp withstands shocks at 2,000 ft.-lb.

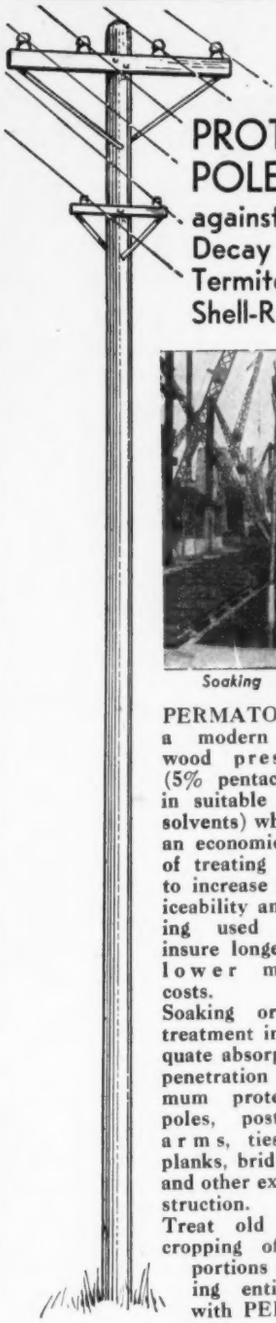
Welder



"Fleet-Arc Jr" arc welder for farm and shop use: wt. 360 lb.; supply, 230-volt single-phase circuit; range, 20 amp. at 20 volts to 180 amp. at 25 volts; accommodate electrodes from 1/16 in. to 5/32 in. diameter; used with 3-kva. transformer. **Lincoln Electric Co.**, Cleveland 1, Ohio.

Portable welder designed to meet the limited input requirements on rural lines and is reported to meet NEMA standards for this type of welder. It includes a new development known as "Arc Booster" which facilitates arc starting. It has a snap switch for selecting either of two degrees of arc boosting—one for general work and one for thin materials.

PERMATOX "A"



PROTECTS POLES
against
Decay
Termites
Shell-Rot

Soaking Method

PERMATOX "A" is a modern type of wood preservative (5% pentachlorphenol in suitable petroleum solvents) which affords an economical method of treating new poles to increase their serviceability and reclaiming used poles to insure longer life and lower maintenance costs.

Soaking or pressure treatment insures adequate absorption, deep penetration and maximum protection for poles, posts, crossarms, ties, crossing planks, bridge timbers and other exposed construction.

Treat old poles by cropping off decayed portions and spraying entire length with PERMATOX "A".

Furnished in Two Forms:—

DOWICIDE 7
Pentachlorphenol crystals

PERMATOX "A"
5% Pentachlorphenol in suitable petroleum solvents

Write for Bulletin—Dept. "E"

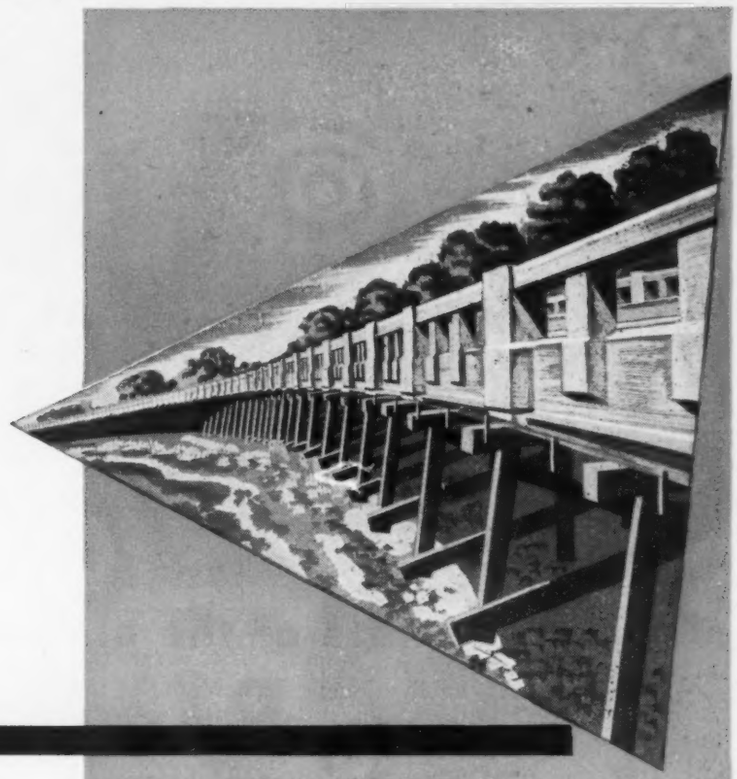
A. D. CHAPMAN & COMPANY, INC.

333 N. Michigan Ave., Dept. "E"
Chicago 1, Ill.

Chicago · New Orleans · Portland
New York · Atlanta · Memphis
Los Angeles · Houston

ONE OF THE MANY DOW CHEMICALS USED BY AMERICAN INDUSTRY

50,000,000,000 termites can be wrong!



Fifty billion termites on the loose . . . a real menace to the lumber industry! There are at least that many of these pests throughout the nation, looking for a meal from anything that's made of wood.

Preserving wood from termites and fungi looked like another job for Dowicide. Dow technicians tackled the problem . . . submitted their findings to the lumber industry. In actual practice, it was found that Dowicide-treated lumber resisted termites, rot, and mold for unusually long periods of time . . . stayed clean, was easily handled, non-bleeding, paintable.

Today there's a longer life in store for many wood products—thanks to Dowicide. The range of Dowicide treatments now available offers simple, economical protection of wood from freshly cut logs to finished product.

Not only in the lumber industry, but in many another major field as well . . . paper, paints, leather, textiles . . . Dowicides are providing efficient protection against mold and decay. Bring *your* preservative problem to Dow! We'll be glad to help work out the Dowicide defense that's best for you.

THE DOW CHEMICAL COMPANY

MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit
Chicago • St. Louis • Houston • San Francisco • Los Angeles • Seattle

Dowicide

Germicides and fungicides

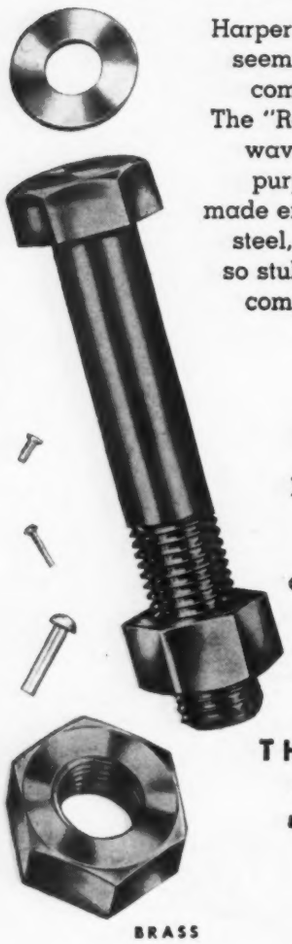
DOW

CHEMICALS

INDISPENSABLE TO INDUSTRY

in spite of the elements

Harper Everlasting Fastenings, at first glance, may seem remote from the Rock of Gibraltar, but the comparison is closer than you might suppose. The "Rock" has withstood the elements of wind and wave and time for centuries. To all intents and purposes it is Everlasting. Harper fastenings, made exclusively from non-ferrous metals or stainless steel, also resist the elements, rust and corrosion so stubbornly that they are considered Everlasting compared with common steel—or the products in which they are used.



everlasting fastenings

Harper Everlasting Fastenings may be ordered from a stock of over 5000 items including bolts, nuts, screws, washers, rivets, nails and special fastenings. Other special fastenings are made to order quickly from large stocks of raw material. Write for 104 page catalog.

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TECHNICAL LITERATURE

Safety for Metermen—"Recommended Safety Practices for Electrical Metermen" is a 32-page booklet which describes accidents in relation to tools and equipment, meter shop equipment, work on customers' premises and automobiles. The publication, which carries the number M-15, may be procured from Edison Electric Institute, 420 Lexington Ave., New York 17, N. Y., for 25 cents per copy. Additional copies may be obtained at reduced rates.

Standards—"1945–1946 A.S.T.M. Standards on Electrical Insulating Materials" is a compilation of more than 75 widely used specifications and test methods on electrical insulating materials and related products. Included are several reports covering the significance of tests of insulating materials, a proposed method of testing askerels, and most recent recommendations affecting standards on electrical insulating materials. Also contained are groups of standards covering insulating varnishes, paints, lacquers and their products. Plates, sheets, tubes and rods are covered in 21 standards; there are four standards on mineral oils and six pertaining to ceramic products. Specifications and methods on insulating paper, mica products, rubber products, textile material, etc., are grouped. This 560-page bulletin may be obtained from American Society of Testing Materials, 260 South Broad St., Philadelphia 2, Pa., for $3.25 per copy.

Manual—"Ready Reference Electrical Insulating Materials Manual" is designed as a reference bulletin for use of engineers, designers and allied personnel in the electrical manufacturing, radio and electronic fields of industry. Among the subjects discussed are the theory and behavior of dielectrics, mica and mica plate, organic vs. synthetic materials, liquid dielectrics, varnishes for electrical insulation, inorganic insulations, plastics and coordinated and standard conductor insulation. Copies may be obtained from William Brand & Co., 276 Fourth Ave., New York 10, N. Y.

Welding Standards—NEMA publication No. 45-105 is a complete set of new standards for electric arc welding machines and electrodes. This revision supersedes No. 42-81 and incorporates changes resulting from wartime experience, and covers a most important post-war requirement—a.c. welders for the farm and small community repair shops. Copies are obtainable from National Electrical Manufacturers Association, 155 E. 44th St., New York 17, N. Y., for 75 cents each.

Joint Construction—Two publications—M-5, "Reports of Joint General Committee on Edison Electric Institute and Bell Telephone System on Physical Relationships between Electrical Supply and Communication Systems," and M-12, "Joint Pole Practices for Supply and Communication Circuits," are available from Edison Electric Institute, 420 Lexington Ave., New York 17, N. Y. Publication M-5 is a reprint of three reports previously issued and M-12 is a revision of publication E-3. One of the most important changes is provision for normal joint use construction in situations where primaries exceed 5,000 volts.

Pump Manual—A "Contractor's Pump Manual" supplies information on four types of portable pumps used in the construction, mining, industrial and other fields. The four types are the self-priming centrifugal, diaphragms, well-point and road pumps. In each case the pumps are described and their particular advantages and limitations outlined. A pump selection table is included as is a trouble check-sheet, a maintenance timetable, do's and don't's, and engineering tables. Copies may be obtained from the Construction Foundation, Associated General Contractors of America, Munsey Building, Washington 4, D. C., for 50 cents each.

NEWS ABOUT PEOPLE

L. S. Wilcoxson Assumes New Executive Duties

Announcement has been made by the Babcock & Wilcox Co. of the election of L. S. Wilcoxson as vice-president to be in charge of research and development.

L. S. Wilcoxson

Mr. Wilcoxson will have supervision of all the Babcock & Wilcox Co. development work wherever performed. A corps of chief assistants to Mr. Wilcoxson have been named. They are P. R. Cassidy and E. D. Grimison, executive assistants; R. M. Hardgrove, research development consultant, and J. P. Moran, in charge of patents.

Before his appointment, Mr. Wilcoxson held the position of executive assistant. A graduate of the University of Liverpool, Mr. Wilcoxson served from 1923 to 1926 as test engineer with the Carnegie Steel Co. in Duquesne, Pa., and since 1926 has been associated with the Babcock & Wilcox Co.

•

▶JOHN W. DIXON has been appointed director of the branch of project planning in the Bureau of Reclamation. Mr. Dixon has been acting director of the branch since October, 1945. Before joining the Bureau's staff as engineering assistant to the Commissioner, Mr. Dixon served with the War Production Board. Other experience included three years with the National Resources Planning Board and thirteen years with the Corps of Engineers of the War Department in connection with work on the Mississippi River and Tributary Dam system.

•

Public Service Announces Publicity Appointments

Announcement has been made by President George H. Blake of Public Service Electric & Gas Co., Newark, N. J., of the following organizational changes in the company's publicity and advertising department in connection with the retirement of Walter F. Allen as director of publicity:

Robert A. Zachary, vice-president in charge of public relations, will head the publicity and advertising department.

Joseph A. Gallagher is named director of publicity and Thomas H. Spain director of advertising. S. Earle Clauss will be assistant director of publicity.

Mr. Zachary has been vice-president for the past six years, a director of the subsidiary companies since 1941, and has been associated with Public Service since 1930.

Publicity manager since 1942, Mr. Gallagher has been in the publicity department of Public Service 21 years. Mr. Spain has been with the organization since 1927 and for the past eight years has been advertising manager. He is a director and past-president of the Public Utilities Advertising Association.

Mr. Clauss has been connected with the publicity department of Public Service since 1937.

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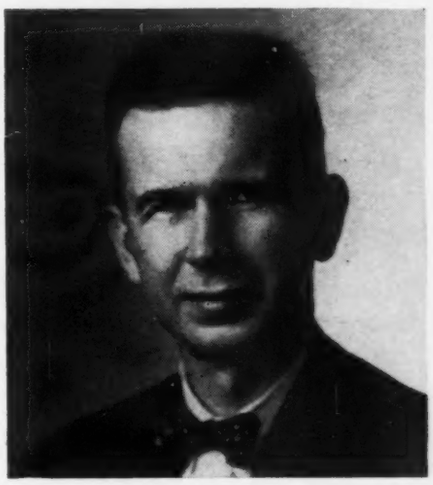
▶JOSEPH I. WEST, district manager of the Litchfield (Conn.) Electric Light & Power Co. since 1923, has resigned. He began work as a generator operator with the Washington Electric Light Co. in 1906, later joining the Litchfield company, which was acquired by the Connecticut Light & Power Co. in 1943. ROBERT I. COLEMAN, assistant to the manager of the C. L. & P. company's western division, Waterbury, succeeds Mr. West.

Sprague Electric Elects Two New Vice-Presidents

At a recent meeting of the directors of the Sprague Electric Co., North Adams, Mass., Julian K. Sprague and Dr. Preston Robinson were elected vice-presidents of the company.

J. K. Sprague

Mr. Sprague's association with the company dates back to 1926 when he became one of the original group of four employees at the old Quincy, Mass., plant, where he served as production manager. He has been actively engaged in sales engineering phases of the business since that time. He played an important part in the development of the famous Sprague "Midget" capacitor. In 1930 he represented the company in Canada, where he was instrumental in developing many of the company's sales contacts. This work was followed by five years in the Detroit office and he returned to assume a variety of duties in the North Adams general offices in 1940. Early in the war, Mr. Sprague was appointed a consultant on capacitors by the War Production Board.



Dr. P. Robinson

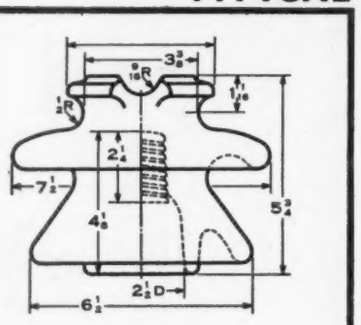
Dr. Robinson has been associated with

THOMAS
PIN TYPE INSULATORS

Here are a few transmission line Pin Types selected from our complete line of Porcelain Insulators by Engineers for their dependability and record for long time service.

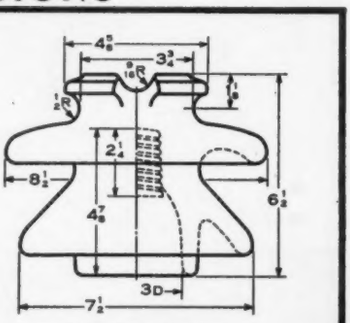
For complete engineering details and a copy of our latest Catalog No. 40—mail the coupon below.

TYPICAL DESIGNS



NO. 1917-M
27 Kv. Rating

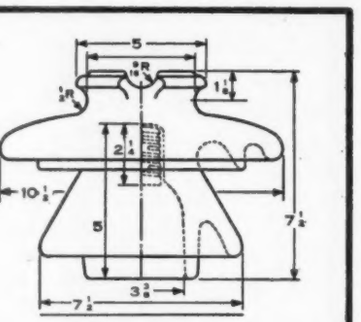
Dry Flashover	95 Kv.
Wet Flashover	65 Kv.
Rec. Pin Height	7 In.
Std. Pkg. Bbl.	25



NO. 1925-M
35 Kv. Rating

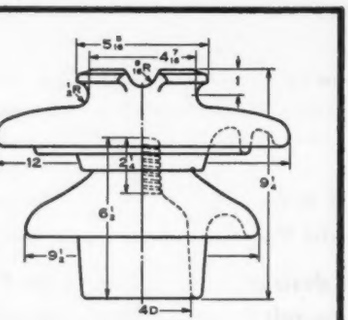
Dry Flashover	110 Kv.
Wet Flashover	75 Kv.
Rec. Pin Height	8 In.
Std. Pkg. Crate	8

All Thomas Pin Type Insulators can be furnished in "Quiet-Type" insulators for the positive elimination of insulator radio interference. To order "Quiet-Types" simply specify "Q-T" after catalog number.



NO. 1924-M
45 Kv. Rating

Dry Flashover	125 Kv.
Wet Flashover	85 Kv.
Rec. Pin Height	9 In.
Std. Pkg. Crate	6



NO. 2126-M
55 Kv. Rating

Dry Flashover	145 Kv.
Wet Flashover	100 Kv.
Rec. Pin Height	10 In.
Std. Pkg. Crate	3

The above one-piece designs can also be furnished in two-part designs when preferred. Both designs are very rugged, well balanced, and proved by years of continuous line service.

THE R. THOMAS & SONS CO.
Lisbon, Ohio

Please send me your Catalog No. 40 illustrating Porcelain Insulators and Line Hardware for Distribution Lines.

Name ..... Title .....

Address .....

City and State .....

THE R. THOMAS & SONS CO.
LISBON, OHIO
New York · Boston · Chicago

the company since 1929, serving as chief engineer and director of research. His specialized studies have included exhaustive research of equilibria at high temperatures, the metallurgy of tin, thermodynamics and dielectrics. During recent years with Sprague, he has been engaged almost exclusively in war work of a highly important character. His wartime direction and coordination of the work of the Sprague research and engineering staff contributed materially to the successful completion of a number of top priority projects.

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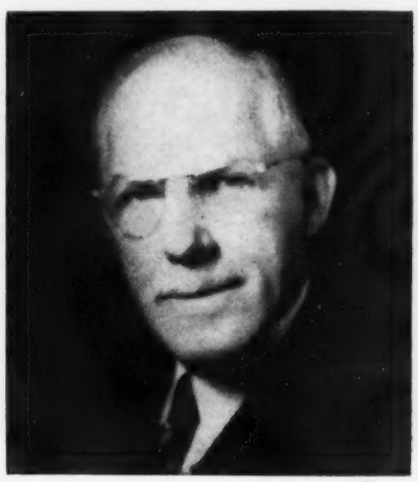
E. I. Rudd Joins Staff of William S. Leffler

E. Irvine Rudd has joined William S. Leffler, Engineers Associated, of Noroton, Conn., consulting engineers specializing in utility rate problems and cost analyses.



E. I. Rudd

Last October, Mr. Rudd retired as chief engineer of the Connecticut Public Utilities Commission. Following graduation from Mississippi Agricultural and Mechanical College and from Rensselaer Polytechnic Institute, Mr. Rudd spent sixteen years in railroad location, construction and design until he entered the service of Connecticut in 1917. During his 28 years as chief engineer, Mr. Rudd was intimately associated with the work of the commission in utility rate, service and valuation matters.

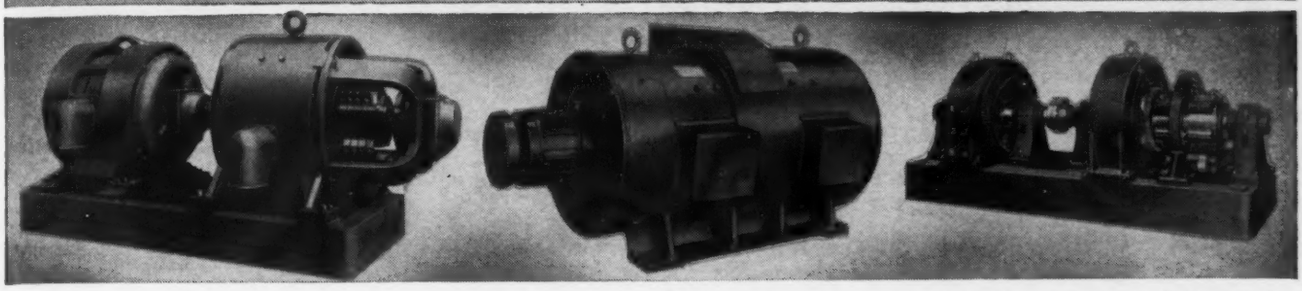
He has frequently contributed technical papers to the Annual Conferences of State Utility Commission Engineers and is a registered professional engineer in Connecticut.

•

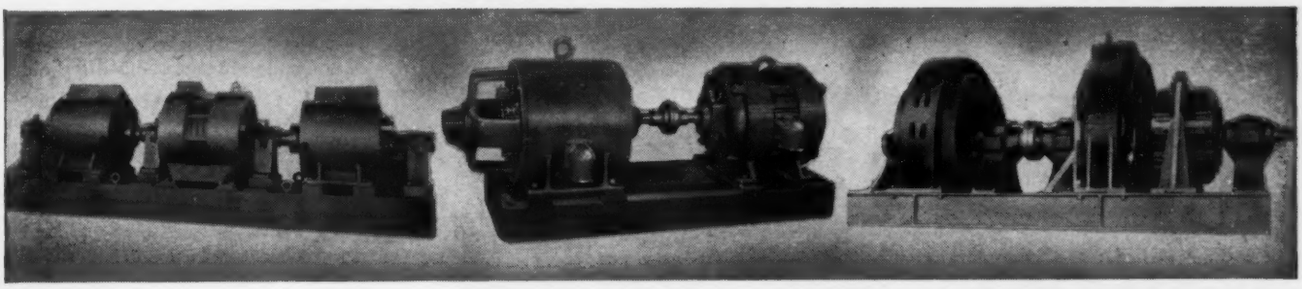
▶ NEAL WILLIAMS has been appointed chief industrial engineer and E. L. BLAIR as chief building service engineer of the Stone & Webster Engineering Corp. Mr. Williams became associated with the Stone & Webster Engineering Corp. in 1937 as an engineer in the mechanical division. He was in charge of a number

THERE'S ONE CORRECT M—G SET

• *that best fits into your plant*



▲ 75 k.w. M-G Set Induction Motor Driven
▼ 300 k.w. 3 Unit Synchronous Motor Driven
▲ 25 k.v.a., D.C. to A.C. 2-Bearing M-G Set
▼ 5 k.w. Exciter M-G Set
▲ 500 k.w. Synchronous Motor Driven M-G Set
▼ 1000 k.w. Synchronous Motor Driven



BURKE IS GEARED TO BUILD IT

ABOVE are illustrated a few typical Burke M-G Sets. These will remind you that Burke is able to meet your most exacting specifications up to capacities of 1000 KW. Burke, one of the oldest and largest independent builders of synchronous equipment and a pioneer in the manufacture of DC equipment, has the experience to design and build the correct M-G set for your power needs. State KW and voltage desired on generator and voltage, phase and cycle for motor drive — describe the application to be made.

For a description of the complete Burke line of AC and DC motors and generators, consult Sweet's Engineering catalogs or Electrical Buyers Reference catalog.

For immediate assistance, telephone our nearest representative:

BURKE AGENTS AND REPRESENTATIVES

ATLANTIC ENG. CO.
185 17th Street N. E., Atlanta, Ga., Phone: Hemlock 6461
C. E. WINCHELL
205 Perry-Payne Bldg., Cleveland, O., Phone: Cherry 5634
INDUSTRIAL EQUIP. CO.
6823 Navigation Blvd., P. O. Box 9155, Houston, Texas, Phone: Woodcrest 62693
BURKE ELECTRIC CO.
Room 234, 1600 Arch St., Philadelphia, Pa.
Phone: Rittenhouse 5226
P. A. MORSE
Fullerton Bldg., Room 600, St. Louis, Missouri
Phone: Garfield 0076
BURKE ELECTRIC CO.
Room 1515, Engineering Bldg., Chicago, Illinois
Phone: Franklin 5061
BURKE ELECTRIC CO.
Roosevelt Theatre Bldg., Detroit, Mich., Phone Plaza 7232
BURKE ELECTRIC CO.
Room 1704, 274 Madison Ave., New York City, N. Y.
Phone: Lexington 2-5330
F. E. BURKE
416 Maple Ave., Pittsburgh 18, Pa., Phone: PEnhurst 5357
NORTHWESTERN AGENCIES
2411 First Avenue, Seattle, Washington
Phone: Elliot 8882

MOTORS 1 TO 1500 H. P. • GENERATORS 1 TO 1000 K. W.

BURKE A.C. & D.C. Motors & Generators

BURKE ELECTRIC COMPANY, ERIE, PENNSYLVANIA • *Since 1891*

They share the load AUTOMATICALLY . . . WITHOUT ATTENTION

Assuring an adequate and uninterrupted supply of direct current (for control bus, circuit breaker and emergency loads) . . . automatically and without manual attention . . . DEMANDS the "teaming together" of only the most dependable Batteries and Full-Automatic Chargers. That the "Diverter-Pole" Charger ranks at the top of the list is supported by thousands of installations made in the past 30 years . . . PROOF that the "Diverter-Pole":

★ **ASSURES MAXIMUM BATTERY LIFE** . . . Only the constant voltage method of charging protects the battery against over-charging during the Floating-Charge period. Analyze Zone 1.

★ **SHARES LOADS WITH BATTERY** . . . Its "constant-voltage" characteristic permits the "Diverter-Pole" Charger to carry *all* loads within its *safe* capacity. The change to a "constant-current" characteristic (Zone 2) shifts *automatically* dangerous overloads to the "team-mate" battery operating in Zone 3 . . . thereby protecting itself against harmful overloads.

★ **GIVES FULL-AUTOMATIC OPERATION** . . . Increasing use of "Diverter-Poles" in isolated automatic and supervisory-controlled substations is convincing evidence that this type of charger needs only infrequent inspection. Its voltage *automatically* remains constant despite fluctuations in load or a-c power supply.

Write for Descriptive Bulletin No. 96-A

THE ELECTRIC PRODUCTS COMPANY

1731 Clarkstone Rd. Cleveland 12, Ohio

EP

X-4

of important war-time industrial projects undertaken by the corporation. Mr. Blair became associated with the corporation in 1926. Since 1939 he has been an industrial engineer in charge of heating, ventilating, plumbing and other building service work.

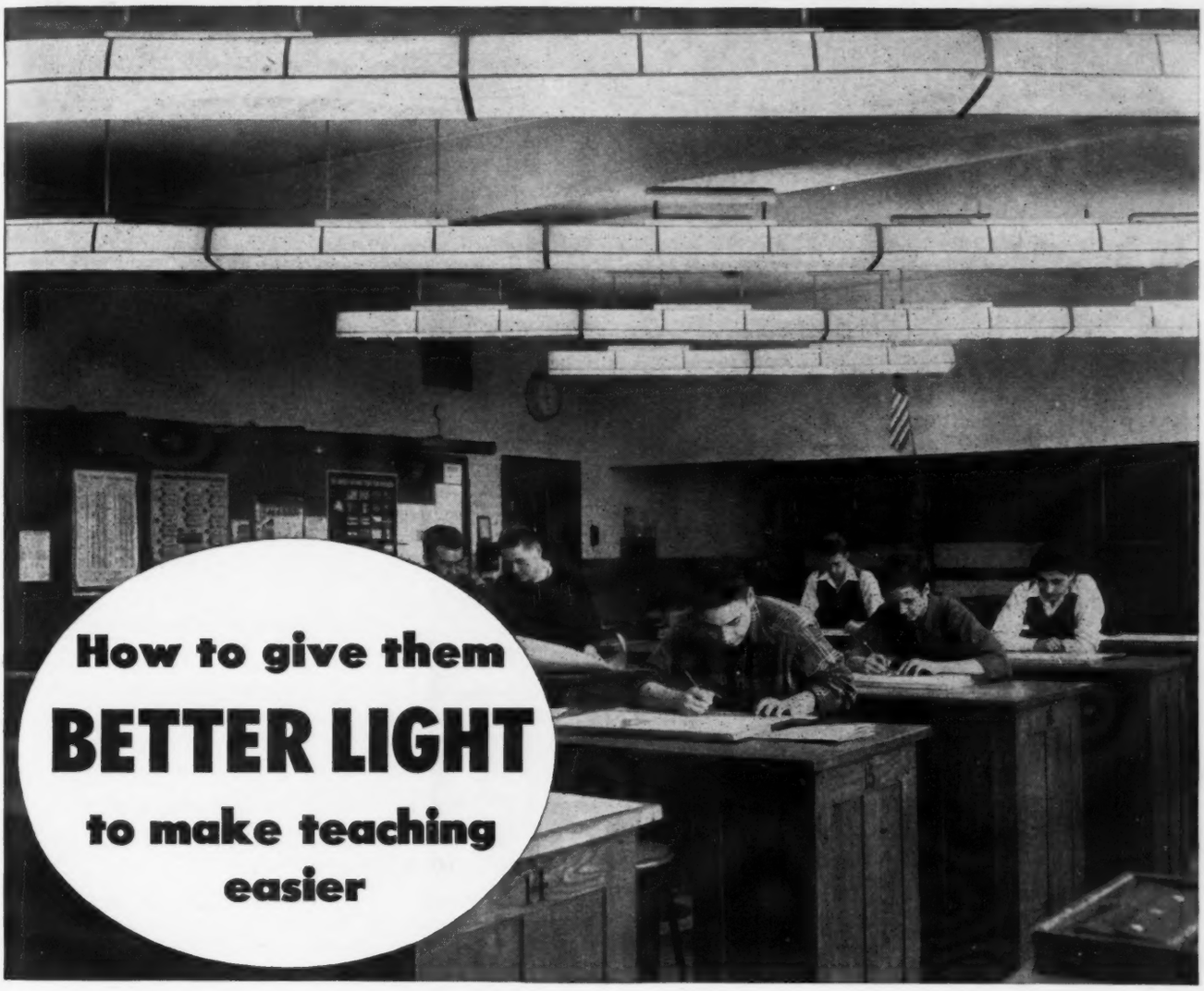
•

Official Changes Made by Connecticut Utility

Effective Jan. 1, 1946, several organization changes took place on the Connecticut Light & Power system: Walter P. Schwabe, northern division manager, Thompsonville, and H. D. Larrabee, eastern division manager, Willimantic, retired from service; B. H. McElhone, New Britain manager, became manager of the Essex district; Hugh T. Corcoran, electric distribution engineer for the company, was made New Britain manager; Abner C. Bristol, Essex division manager, became northern division manager, and Gilbert J. Williams, eastern division engineer, was named eastern division manager.

Mr. Schwabe entered the utility field in New Jersey about 50 years ago as a station apprentice. In 1908 he became superintendent and general manager of the Northern Connecticut Power Co., Windsor Locks, vice-president in 1913 and president and general manager in 1925. After the company's acquisition by the C. L. & P., he became northern division manager, and has widely diversified interests and responsibilities in civic and business affairs in local and national organizations. Mr. Larrabee was graduated from the Massachusetts Institute of Technology in 1902, and was employed by General Electric, and by utilities in Puerto Rico, Illinois, Indiana and Vermont until 1919, when he went to Norwich as manager of Eastern Connecticut Power. In 1929 he became eastern division operating superintendent of the C.L.&P., which acquired Eastern C.P., and in 1937 was named eastern division manager. He has also been active in industry-wide and local organizations.

Mr. Bristol, a University of Vermont graduate, joined the company in 1921, and has been manager of the New Milford, Winsted and Essex districts. Mr. McElhone entered Westinghouse employ in 1909. In 1926 he became New Britain manager of the C.L.&P., and now is promoted to manage the widespread and fast-growing Essex territory. Mr. Corcoran joined the C.L.&P. in 1917 at Waterbury, later serving as a cadet engineer, line inspector, acting distribution engineer at Greenwich, field engineer at Waterbury and then electric distribution engineer for the system. Mr. Williams entered the company's service in 1920, worked in various capacities in the operating department in several locations, was division



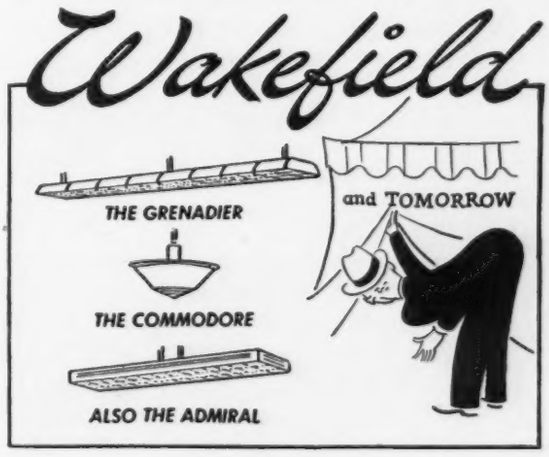
Wanted: Light for the drafting room of the Pontiac VOCATIONAL SCHOOL, Pontiac, Michigan, that would help pupils learn faster and make the close eye work of drafting easier, less strain.

Problem: Providing high level, overall lighting, with good distribution on walls and ceiling for greater eye comfort . . . despite the interference of large beams on the ceiling.

Solution: Lighting engineers of the Consumer's Power Company produced a practical and effective answer—continuous rows of Wakefield GENERALS (G-260) mounted diagonally to the drafting tables. This gives good shadow control, and the open top and plastic sides help provide comfortable light distribution, with 52 foot-candles on drafting boards. In this 26 by 40′ room with 12′ ceiling, 19 units are used, each with two 100-watt fluorescent lamps. Mounting height 10′ above the floor.

School rooms in your territory may require different treatment, different equipment. But you can be sure that Wakefield will be glad to work with you in securing engineered lighting to fit your customers' needs. The F. W. Wakefield Brass Co., Vermilion, Ohio.

Are Your Customers Throwing Away Dollars? *Proper lighting maintenance—cleaning fixtures and walls and relamping—can double or triple their lighting. Urge them to get the light they pay for—keep lighting equipment clean!*



CHAMPIONS ALL

Champion Lamps cover the full range for industrial service, including:

CHAMPION *Fluorescent Lamps*

white or daylight, in all standard wattages and lengths; *Instant Start* Fluorescent Lamps for the new instant start circuit; *Low Temperature* Fluorescent Lamps for cold or exposed locations.

CHAMPION *Incandescent Lamps*

clear, inside frost, white bowl and silvered bowl for general lighting service; *Vibration Service* Lamp; *Rough Service* Lamp; *Spotlight, Floodlight* or *Reflector* Lamps; *Infra-Red* Lamps.

Whatever the types and sizes you need, select lamps bearing the CHAMPION Diamond mark, signifying these four "diamond points" of value.

1. **Champion Quality** — guaranteed to equal or exceed Federal Specifications.
2. **Champion Service** — trained lighting experts in the field to help you choose the one best lamp for each and every lighting application.
3. **Champion Economy** — Champion Lamps for industry are designed and distributed to assure minimum lighting cost as well as lamp cost.
4. **Champion Supply**—through carefully selected industrial distributors equipped to meet your needs promptly and efficiently.

CHAMPION LAMP WORKS

Lynn, Massachusetts

A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO

manager at New Milford for eight years and for the past eight years eastern division engineer.

•

Virginia Electric Makes Engineering Assignments

Announcement has been made by E. S. Fitz, general manager of the electric department of the Virginia Electric & Power Co., Richmond, of the appointment of the following former employees recently returned from the Armed Services to the positions indicated:

W. W. Archer, Jr., superintendent of stations and sub-stations in Richmond; E. M. Hawkins, Jr., district superintendent of the Petersburg (Va.) district, succeeding T. J. Peck, resigned; S. P. Woolford, district superintendent of the Albemarle district, Williamston, N. C., and John T. Mason, assistant to the general manager of the electric department, Richmond.

Other personnel changes announced are: R. E. Kimball, formerly acting district superintendent of the Albemarle district at Williamston, who has now been appointed district engineer in the same district, and A. L. Jameson, formerly assistant to the general manager of the electric department in Richmond, who has been transferred to the sales department as director of customer installations.

•

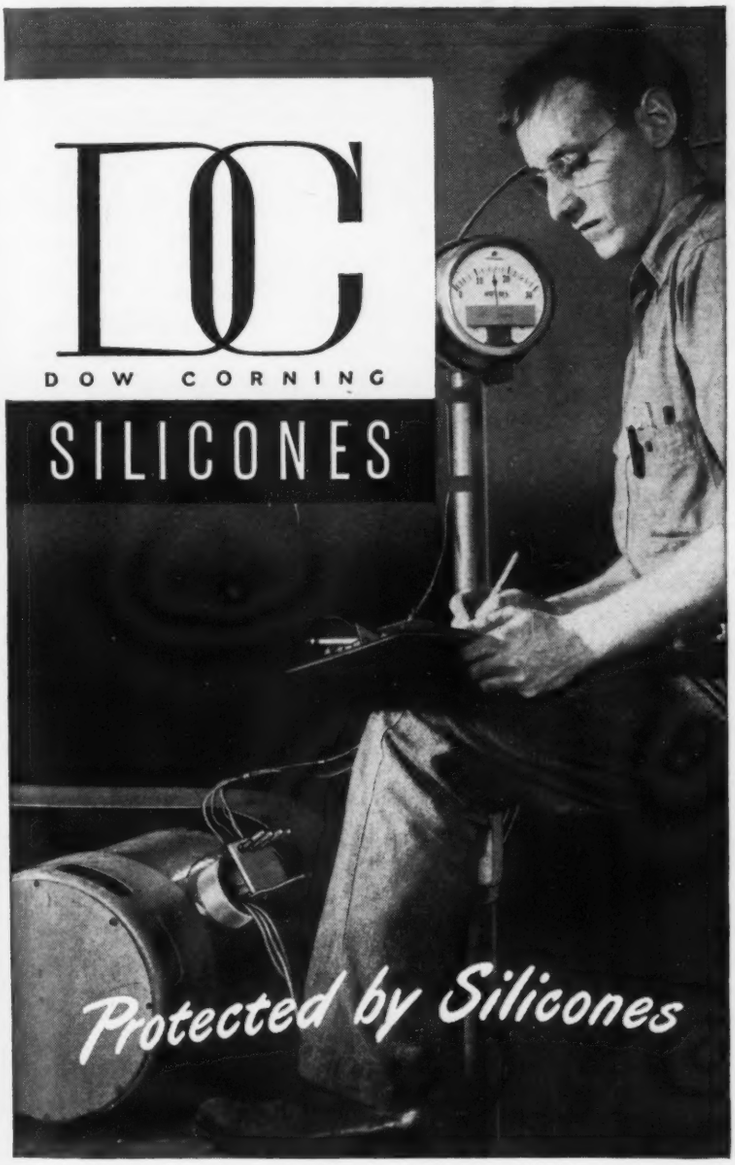
▶ WILLIAM H. OSTERLE, operating department engineer of the West Penn Power Co., has been appointed system planning engineer. Mr. Osterle started with West Penn in 1925 as engineer in the commercial department, Pittsburgh. He worked as division engineer until 1935, when he was appointed service supervisor of the northern division. In 1937 he returned to Pittsburgh as operating department engineer.

▶ THOMAS G. ALLAN, formerly assistant manager of the dealer section of the West Penn Power Co., has been appointed manager of that section, succeeding W. D. PETERS, who recently resigned to become district manager in the home appliance department of General Mills, Inc., Pittsburgh. Mr. Allan has been with West Penn since 1931. J. H. MULLEN, general supervisor of the dealer section, has been promoted to assistant manager.

▶ DR. STEWART G. FLETCHER has joined the Latrobe Electric Steel Co. as chief research metallurgist to direct an expanded research program. He will have headquarters at the Latrobe, Pa., plant. In recent years, Dr. Fletcher has conducted special metallurgical research projects as a research associate at the Massachusetts Institute of Technology. A member of the American Society for

DC SILICONES

Check off Heat!



*Class B Motor Still Running After 130 Hours at 527°F.**

Cross *HEAT* right off your list of electrical maintenance problems! Here's a silicone-protected motor that's going strong in an accelerated-life test already equivalent to normal operation for *an entire human lifetime!*

We took a standard 7½ h.p. Class B insulated motor and impregnated it with the new DC 996 Insulating Varnish. Then we started it running at 527° F.—*over twice the Class B temperature limit*—with intermittent 24-hour periods of 100% humidification. After 18 such cycles, including 130 hours at 527° F., the insulation still excluded moisture—still showed no decline in insulation resistance!

DC 996 means longer life, increased reliability, and added protection against overloads, high temperatures, and excessive moisture. In combination with other silicone insulating materials, it gives even greater protection. Easily applied, it cures at 300° F. For further information, write Dow Corning.

***WHAT ABOUT THE BEARINGS?**

DC 44, the silicone grease for ball bearing lubrication, keeps this motor going at its bearing temperature of 248° F.—an impossibly high temperature for conventional petroleum greases. DC 44 is effective from 0° to 350° F.

DOW CORNING CORPORATION
MIDLAND, MICHIGAN

Chicago Office: Builder's Building • New York Office: Empire State Building
In Canada: Dow Corning Products Division, Fiberglas Canada, Ltd., Toronto.

Dow Corning

FIRST IN SILICONES

INSTRUMENTS YOU CAN AFFORD TO USE

...on everyday jobs

INEXPENSIVE

ACCURATE

RUGGED

EASILY REPAIRED IN CASE OF MISUSE

Hundreds of production line testing jobs and field investigations, in addition to laboratory tests require dependable instruments of a type that don't have to be kept under lock and key because of their extreme delicacy and high cost. Shallcross answers this need with many types of

BRIDGES — DECADE BOXES
RESISTANCE STANDARDS
DECADE POTENTIOMETERS
HIGH-VOLTAGE TEST EQUIPMENT, etc.

These instruments are accurate for every commercial and laboratory need up to the point of the most exacting research in pure physics. They are rugged, easy to operate and decidedly moderate in price. In case of misuse, they can quickly be repaired to full efficiency by any reasonably competent individual without the expense and delay of returning them to the factory.

WRITE FOR BULLETINS

Bulletin 810, Shallcross Resistance Standards
Bulletin 825, Resistance Decades
Bulletin D-1, Bridges
Bulletin LRT, Low Resistance Test Sets
Bulletin G, Electrical Measuring Apparatus for schools and colleges

SHALLCROSS MFG. CO., DEPT. EW-16, Collingdale, Pa.

SHALLCROSS Electrical Measuring Apparatus • AKRA-OHM Resistors • Precision Switches • Electronic Engineering

Metals, he was awarded the Society's Howe Medal in 1945 for his work on the best technical paper of the year. He is a graduate of Carnegie Institute of Technology, and received his doctorate in metallurgy from M.I.T.

•

Philadelphia Electric Group Elects Bryans President

Henry B. Bryans, executive vice-president of the Philadelphia Electric Co., has been elected president of the Electrical Association of Philadelphia. He succeeds Howard L. Miller, president of the Utilities Engineering Co., Philadelphia.

Other officers elected were: vice-president, E. W. Loomis, district manager, Westinghouse Electric Corp.; treasurer, Philip H. Ward, Jr., president of the Ward Electric Co.; and secretary, Robert J. Moran, chief of electrical district, Middle Department Rating Association.

Mr. Bryans has been identified with the public utility industry for his entire business career. He has just been elected president of the American Standards Association for a third term, is a vice-president of the Edison Electric Institute and a past-president of the Pennsylvania Electric Association.

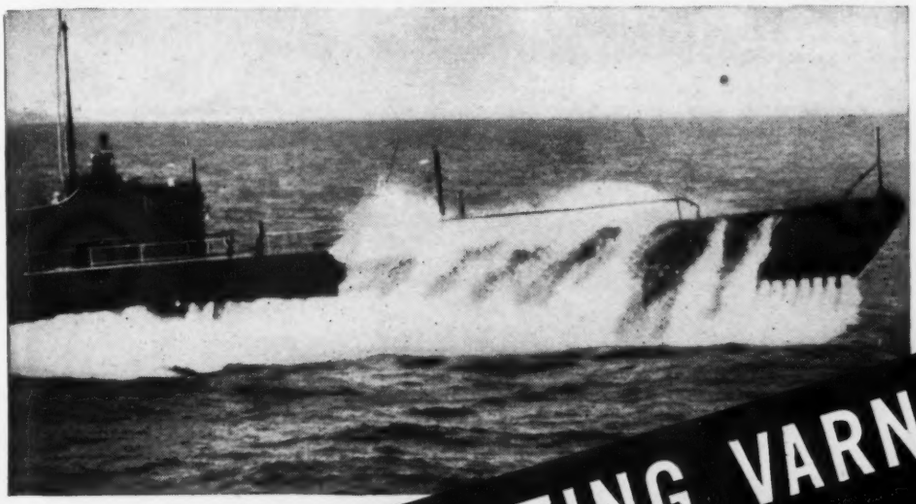
•

▶ HOWARD W. MATHESON, vice-president of the Shawinigan Water & Power Co. in charge of research, is retiring because of ill health.

▶ MERRITT HORNER has been appointed manager of the sales promotion department recently organized by the Holophane Co., New York. Mr. Horner was formerly New England manager of the company. Prominently identified with technical sales promotion in his seventeen years of service with Holophane, Mr. Horner has been active in the New England section of the Illuminating Engineering Society, serving as chairman of many committees.

▶ J. E. UNDERHILL has been appointed director of the industrial development department of the British Columbia Electric Railway Co. at Vancouver to succeed H. N. Walters, who has become general sales manager of the company. In 1927 Mr. Underhill entered the electrical department of the company and three years later became assistant engineer. He joined Royal Canadian Artillery in 1940 and was posted to Halifax before going to Ottawa as director of technical research. After two years he was transferred to directorate of artillery with the rank of lieutenant colonel. Shortly before discharge he became asistant director. He returned to the company as assistant engineer in the electrical department. Before his connection with the

No electrical equipment can be any better than its insulation



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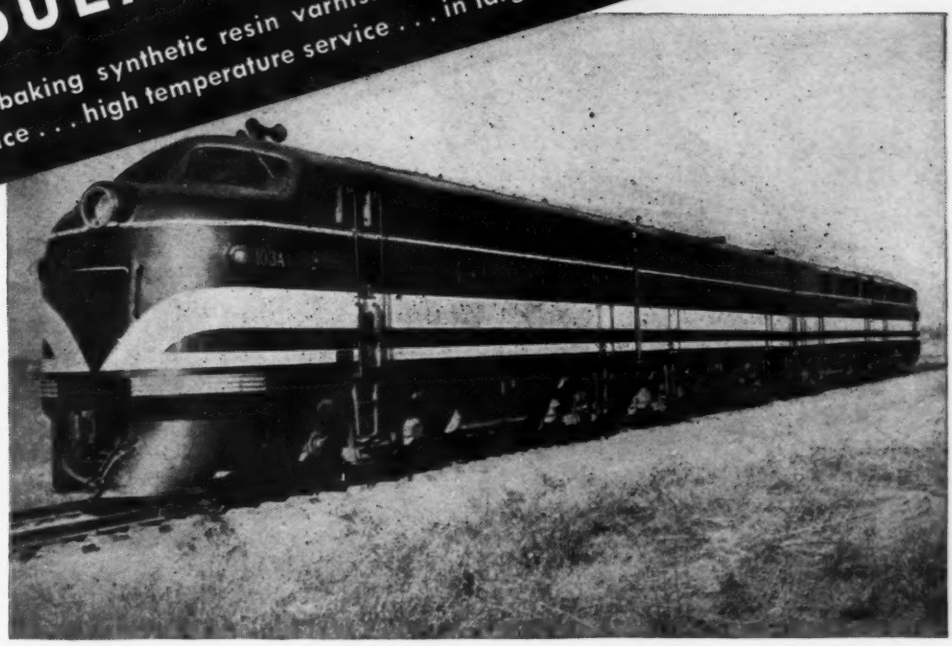

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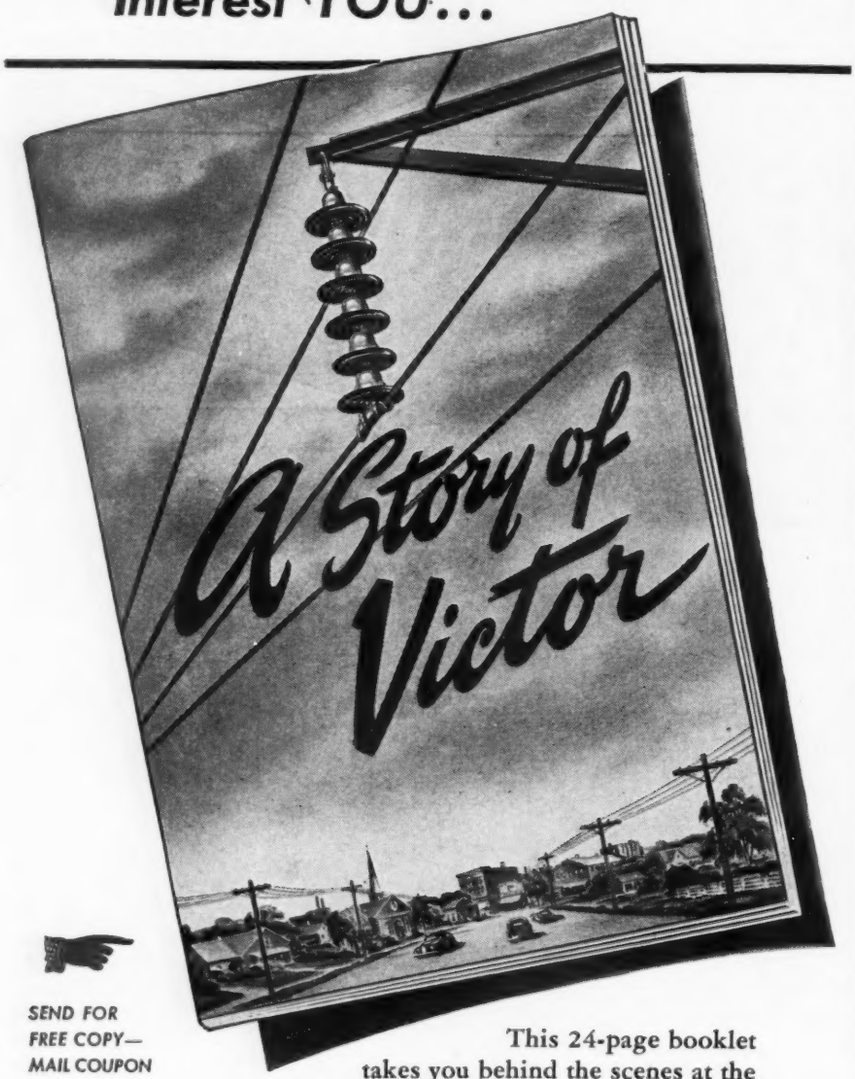

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B. C. utility, Mr. Underhill was associated with Canadian Westinghouse and had also worked with American Westinghouse at Pittsburgh.

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New England Power System Makes Sales Appointments

James F. Dolan, formerly sales supervisor, has been appointed merchandise sales manager of the Lawrence Gas & Electric Co. Roland Campbell, previously a member of the sales department, has been named merchandising manager of the Suburban Gas & Electric Co., Revere, Mass.; John T. Healey, industrial heating and commercial cooking specialist, Worcester County Electric Co., Worcester, Mass., has been made merchandising supervisor for the Worcester division; and Everett A. Geer, sales manager Central Massachusetts Electric Co., Palmer, since 1932, has been appointed merchandising supervisor for that company, the Spencer Gas Co., and the Webster division of Worcester County Electric. All are utilities affiliated with the New England Power System.

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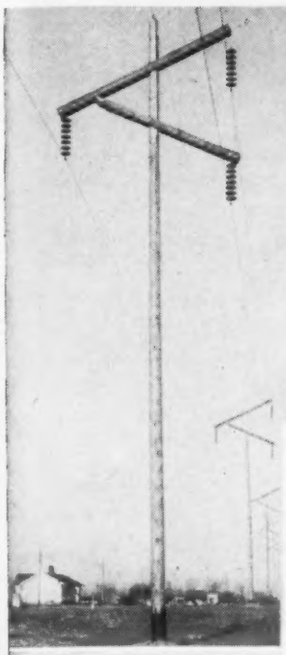
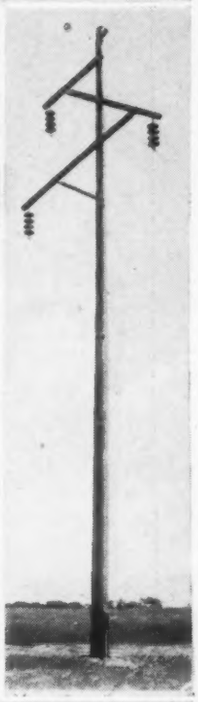
▶ WALTER FRAZIER, of the Graybar Electric Co., has been elected president of the Electric Association of Kansas City.

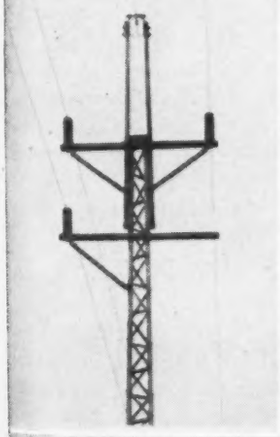
▶ RALPH A. POWERS has been named engineer-in-charge of electronic engineering of the Allis-Chalmers Manufacturing Co. Mr. Powers, formerly with the Bundy Tubing Co., Detroit, succeeds J. M. CAGE, resigned. Mr. Powers attended Massachusetts Institute of Technology, University of Michigan and California Institute of Technology. Before joining Allis-Chalmers he was associated with the Bundy firm, Electronic Control Corp., Detroit, and Bell & Howell Co., Chicago. He is a member of the national board of technical editors of the Institute of Radio Engineers and a former member of the Engineering Society of Detroit and the national committee on surface smoothness of the American Society of Mechanical Engineers.

▶ LOUIS B. F. RAYCROFT, Electric Storage Battery Co., has been elected president emeritus of the Association of American Battery Manufacturers, in recognition of his work in helping to build up the association and his long service as president. He was the original member of the WPB Battery Industry Committee, representing the industry. During the early part of the war, he represented the battery industry on the Federal Labor Supply Committee, a position that later developed into his appointment as chairman of the Manpower commission in the Philadelphia area. Mr. Raycroft was also a vice-president of the National

HUGHES TRANSMISSION – DISTRIBUTION MATERIALS







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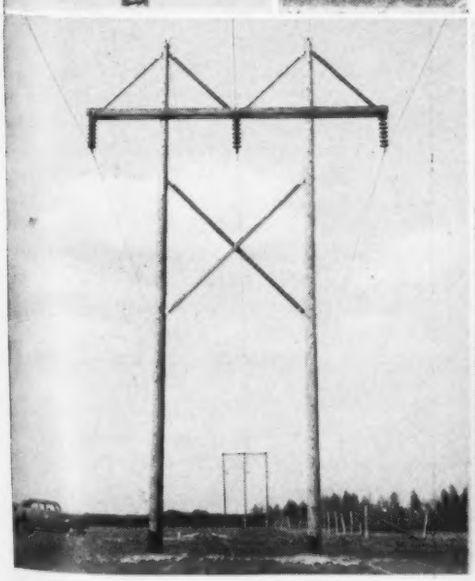

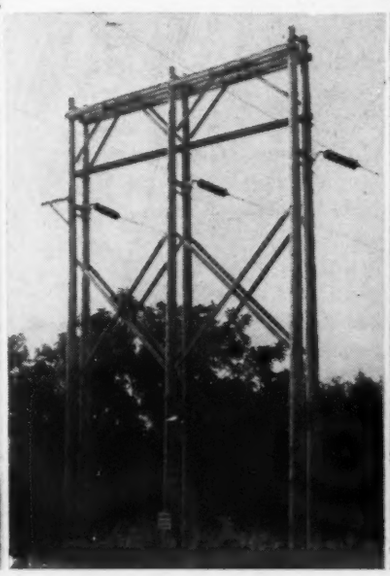

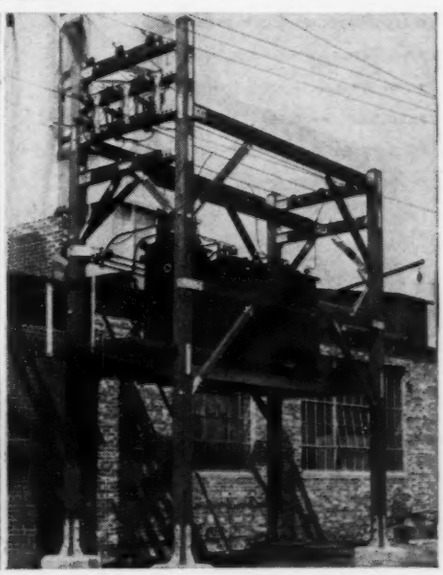

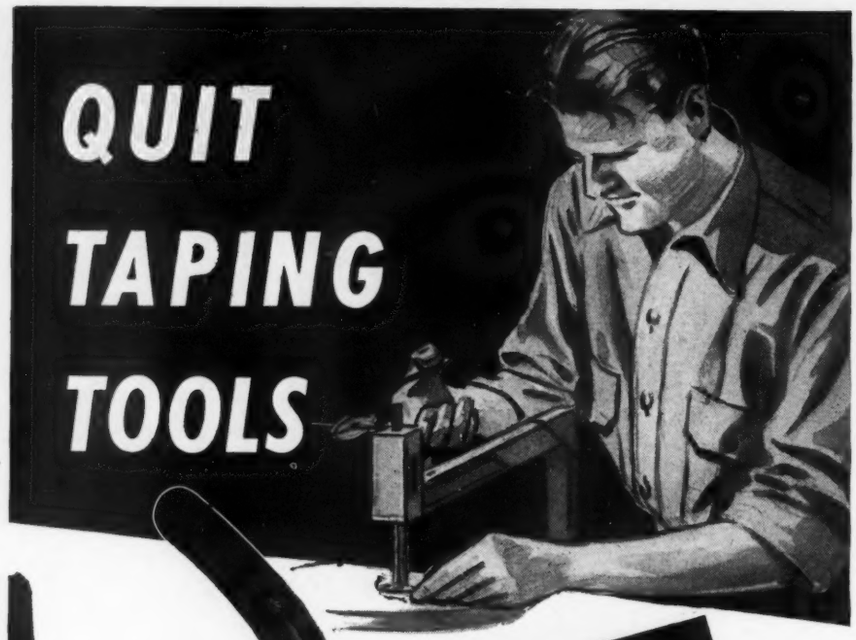

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Electrical Manufacturers Association and chairman of the radio division of that organization. R. L. SOMMERVILLE, also of Exide, was elected chairman of the merchandising division of the American Association of Battery Manufacturers.

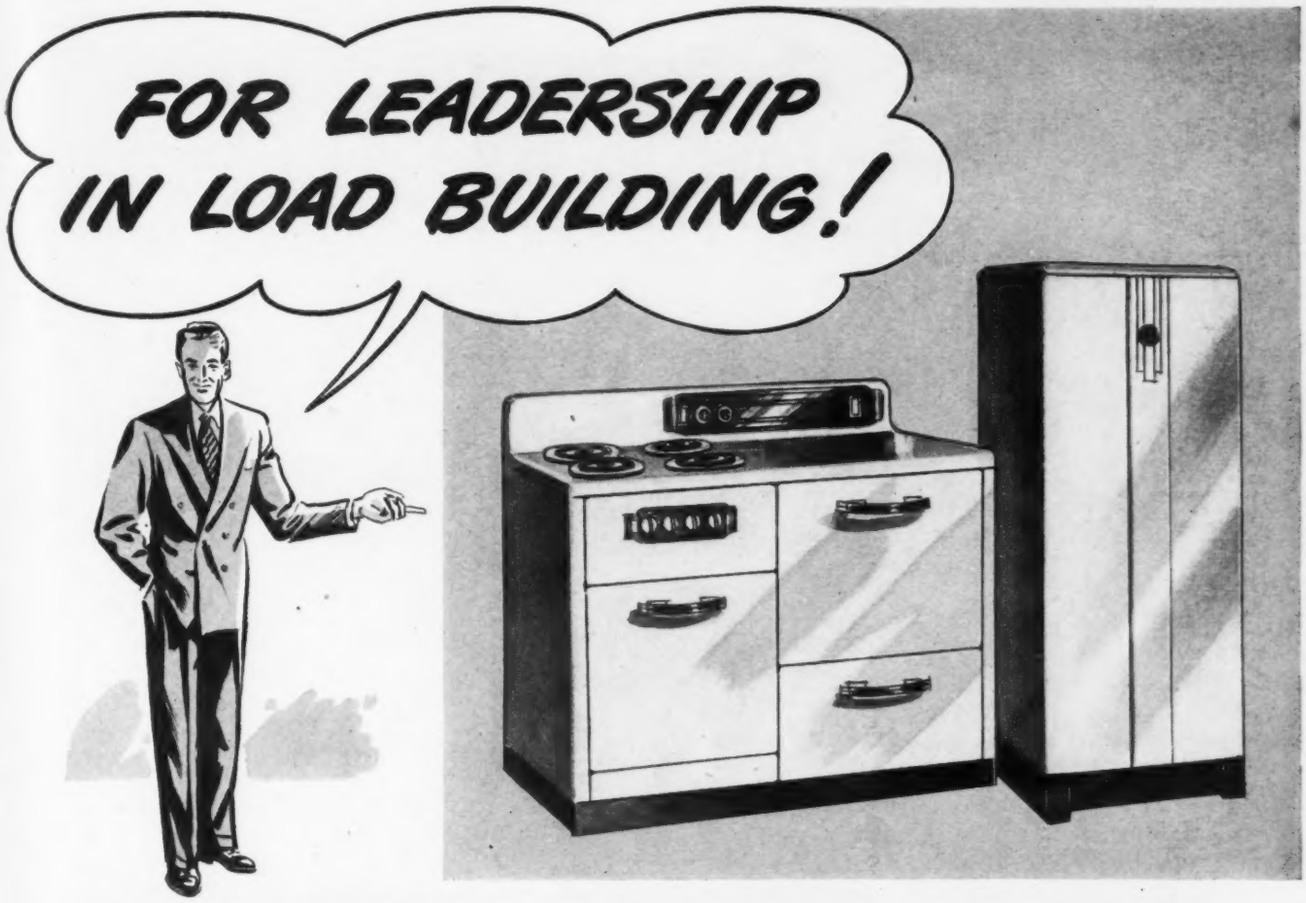
▶ E. FINLEY CARTER, formerly vice-president in charge of industrial relations, Sylvania Electric Products Inc., has been named vice-president in charge of engineering following the resignation of Roger M. Wise. Mr. Carter was assistant chief engineer of the radio division of Sylvania for a number of years. HOWARD L. RICHARDSON, formerly manager of personnel administration, has become director of industrial relations.

▶ H. C. MADSEN, manager, university relations, educational department, Westinghouse Electric Corp., East Pittsburgh, Pa., has been appointed manager, industrial relations, Bryant Electric Co., Bridgeport, Conn., a Westinghouse subsidiary. Before joining Westinghouse, Mr. Madsen was connected with the Philco Radio & Television Corp., Philadelphia.

▶ ROY J. THOMPSON has been added to the engineering section of The Miller Co., Meriden, Conn., to serve as commercial engineer operating out of the factory offices in Meriden. Mr. Thompson, who is a graduate electrical engineer, has had wide experience in illuminating engineering capacities with utility companies. He has also served as lighting specialist with the General Electric Supply Corp. in Oklahoma City. During the war period he was associated with the Austin Company in the capacity of electrical engineer and later served in the Navy as radar design engineer.

▶ DONALD R. EDGE has been appointed assistant rural lines sales manager for the Graybar Electric Co., Inc., with headquarters in Chicago. Mr. Edge has been intimately connected with Rural Electrification Administration activities since 1936, having managed the Union Rural Electric Cooperative in Marysville, Ohio, which he left to organize and later managed the Central Electric Cooperative, Inc., at Parkers Landing, Pa. He previously spent four years with the General Cable Corp. For the past three years, Mr. Edge has cooperated with General Electric Co. engineers in a series of field tests which have led to a number of refinements in transformer and line protective equipment.

▶ LUDLOW KING has been appointed manager of the Washington, D. C., office of the Owens-Corning Fiberglas Corp., Toledo, succeeding C. R. DONOVAN, resigned. Mr. Donovan, who, prior to his six years with the Fiberglas Corp., repre-



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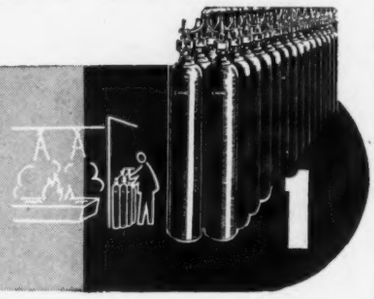
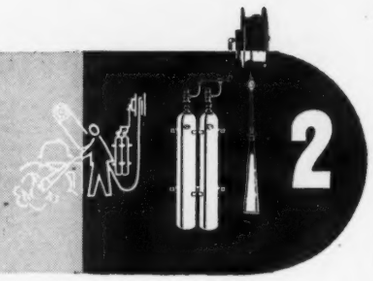


SIMILAR HAZARDS constantly vulnerable are adequately protected by C-O-TWO hose reel units ready for instant action with a fast uncoiling hose ready to blast fires with dry, sub-zero carbon dioxide gas, the fastest non-damaging, non-conducting, non-deteriorating fire extinguishing agent.



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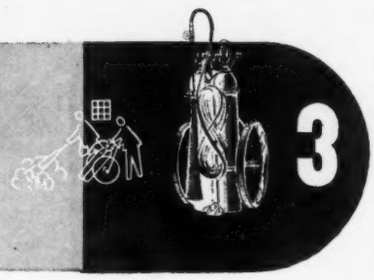

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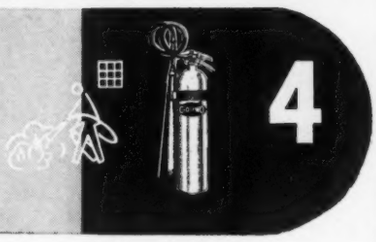

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sented the National Electrical Manufacturers Association in Washington for two years, will establish his own business in that city.

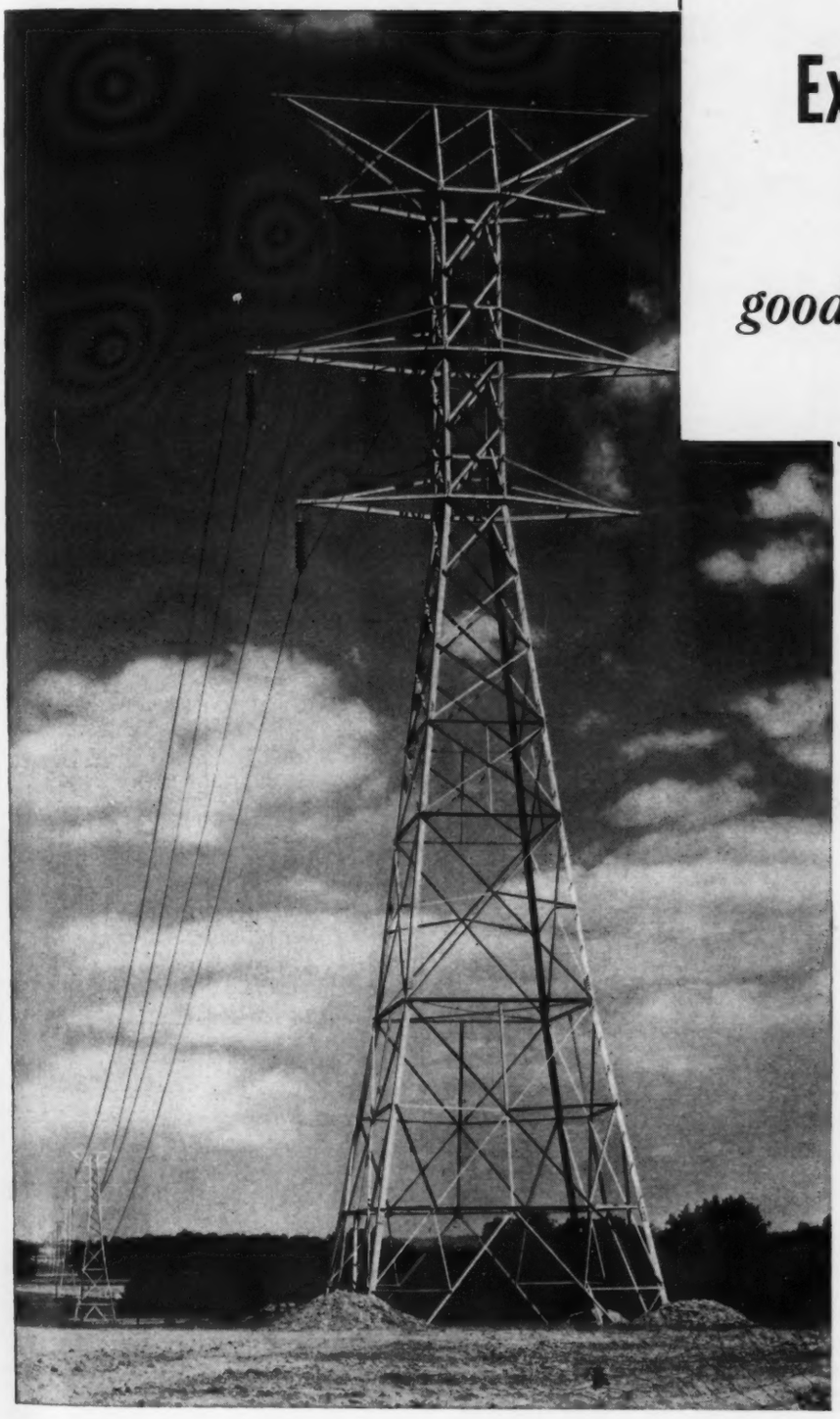
OBITUARY

▶ ARTHUR E. BROOKS, for the past 20 years supervisor of substations of the Georgia Power Co., Atlanta, died on January 5 following a short illness. He was 50 years of age.

▶ EDWARD A. DRISCOLL, commercial manager of the central division of the Public Service Corp. of New Jersey, died on January 8 in Muhlenberg Hospital in Plainfield, N. J., after a short illness. He was 42 years of age. Following graduation from the University of Pennsylvania, Mr. Driscoll went to work for Public Service. From 1942 to 1944, he was manager of the Plainfield office, then was appointed commercial manager of the division.

▶ CLYDE C. RUBLE, Los Angeles engineer in charge of city steam and hydro-generating plants, died in mid-December. He was 63 years old. Born in Kansas in 1882, he became associated with the Colgate hydro-electric plant of Bay Counties Power Co. in 1902, in 1905 was appointed superintendent of the local receiving station of Pacific Light & Power Corp., and in 1907 was made superintendent of the corporation's Borel power plant. Mr. Ruble assumed charge of the Division Creek power plant of the City of Los Angeles in 1910, following which he returned to Pacific Light & Power in 1912 as superintendent of Big Creek power plant in the High Sierras. From 1916 until his death he had been superintendent of San Francisquito power plant No. 1 for the City of Los Angeles, and engineer in charge of operation and maintenance of the water and power plants which supply energy for the city's municipal electrical system.

▶ E. H. HOLDER, superintendent, metering division, operating department, Shawinigan Water & Power Co., died on December 20 at his home in Montreal. Mr. Holder was born at Kingston-on-Thames, England, 57 years ago and was graduated from the University of London in electrical engineering in 1908. His first position in the electrical industry was as assistant on the testing staff of the Newcastle-on-Tyne Electric Supply Co. in 1911. Upon moving to Canada, he joined the British Columbia Electric Railway Co. at Vancouver, and following service in World War I he became identified with Shawinigan as assistant testing engineer. In 1918 he was made meter engineer and in 1943 became superintendent of the meter division, operating department. Mr. Holder was active in the Canadian



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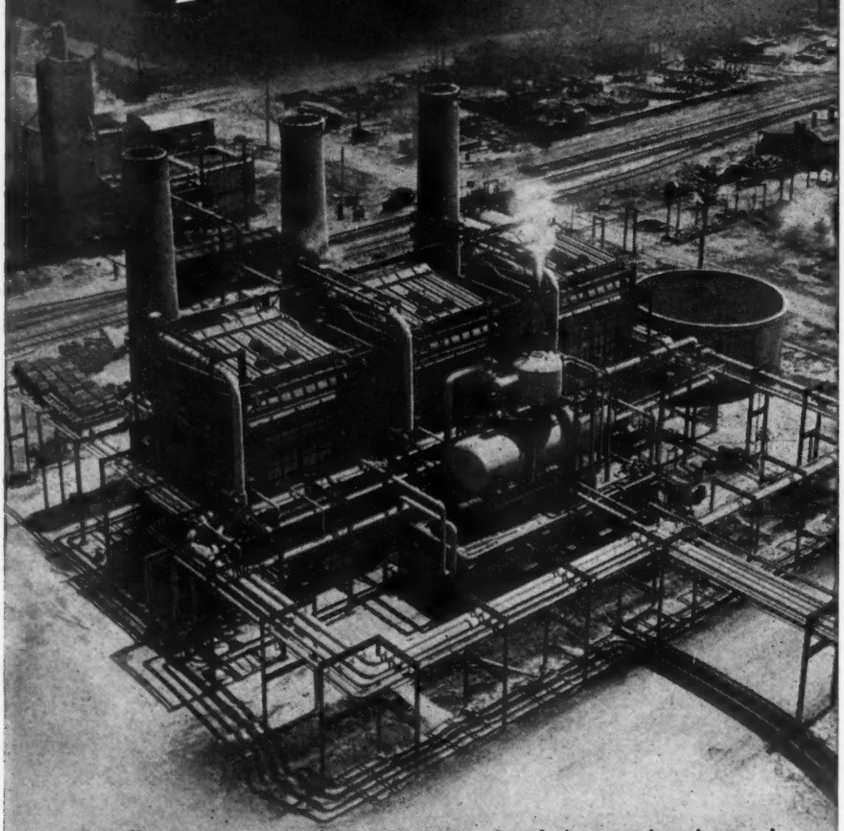

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Electrical Association and the Canadian Electrical Standards Association and was a member of the American Institute of Electrical Engineers.

▶ JOSEPH N. MAHONEY, consulting engineer, inventor and consultant to the works manager of the Wright Aeronautical Corp. of Paterson, N. J., since 1933, died on January 1 at his home in Brooklyn, N. Y., after a brief illness. He was 67 years of age. Mr. Mahoney began his career in electrical engineering in Boston in 1894 with the Electric Storage Supply Co. and through 1906 held positions with the Electro-Chemical Storage Battery Co., New York, Electric Illuminating & Power Co., Long Island City, the New York Air Brake Co. and the American Electric Brake Co. At various other times Mr. Mahoney was associated with the Westinghouse Electric & Manufacturing Co.; Sperry Gyroscope Co., Brooklyn; Condit Electric Manufacturing Co., Boston; American Brown-Boveri Electric Corp., Camden, N. J., and the Pacific Electric Manufacturing Corp., San Francisco. Mr. Mahoney was an active contributor to scientific and professional publications.

▶ JAMES M. BRODBECK, manager of the Chicago division, Welsbach Street Lighting Co. of America, died suddenly of a heart attack on December 25 in Hammond, Ind. He was 61 years old. Mr. Brodbeck joined the Welsbach Group in 1935 as supervisor of safety in the New York office. He became district manager in 1940, and was transferred as division manager to Chicago in 1944. Previous to joining the Welsbach organization, Mr. Brodbeck had been manager of industrial relations, Northern Indiana Public Service Co., where he specialized in employee-management problems.

▶ W. O. SMITH, Denver district manager of General Electric Supply Corp., died December 26. He was 54 years of age. Mr. Smith had been connected with General Electric Supply and its predecessor company at Butte, Mont., since 1915. In 1930 he was appointed district sales manager at Salt Lake City. When the company established two new districts, he was made manager of the Denver area, a position he assumed Jan. 1, 1945. Mr. Smith was a former president of the Electrical League of Utah.

▶ ALBION E. DUNN, an industrial engineer with the Virginia Electric & Power Co., died at a Norfolk hospital on January 2. Mr. Dunn was born in Richmond 40 years ago.

▶ FRED W. MARTIN, owner and operator of the Martin Electric Light & Power Service at Kelleys Island, Ohio, died on December 20 in his seventy-seventh year.

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SAFETY—with ECONOMY—for TOMORROW'S TRAFFIC . . . Across the nation progressive communities are now completing programs for new Traffic Safety Street Lighting . . . And Holophane Refractors play an important role in these plans because they offer outstanding advantages . . . They are designed to shape the light to the street—to place it in the right directions. More light where it is needed means greater visibility for each dollar expended. Holophane Refractors afford savings in maintenance costs too. Made of strong pressed glass they assure longer service life with the highest levels of efficiency . . .

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MANUFACTURING MARKETS

Lower Net Reported by Reliance in '45

Net sales of the Reliance Electric & Engineering Co., Cleveland, for the fiscal year ending October 31, 1945, amounted to $14,518,219, compared with net sales in 1944 of $17,876,935. During the year the company entered orders with a net aggregate value, after deduction for cancellations, of $12,448,094. Unfinished business amounting to $6,210,782 was carried forward.

Net profit was $335,140 after provision for estimated Federal taxes of $830,219, depreciation and amortization of plant and equipment amounting to $267,406 and provision for other contingencies of $150,014. This compares with a net profit for the previous fiscal year of $540,522, from which was deducted a special charge of $275,000 for post-war adjustments.

It was pointed out in the report that renegotiation of the company's 1943 business had been settled without any refund being necessary, while for the fiscal year 1944 a net refund to the Treasury Department of about $124,200 would be required. While final agreement with the Navy has not yet been signed, this amount has been deducted from reserves set up for the purpose.

"Reconversion presents problems of such magnitude," they added, "that it is not possible to predict with any degree of accuracy the company's operations for the next fiscal year. However, in October Reliance entered the largest volume of sales since April 1945, and in November, the first month of the new fiscal year, showed an even greater sales increase, bringing the backlog of firm orders to more than $7,000,000."

•

Forms Lighting Concern

Anthony L. McCabe has disposed of his interest in the Litecontrol Corp., Boston, Mass., to establish the McCabe Lighting Corp., with headquarters at 172 Newbury St. in that city. The newly acquired quarters of the company will contain offices, laboratories and full-scale exhibits of commercial, industrial and decorative illumination.

The company will design and manufacture custom-built equipment for specialized applications, and will also produce commercial and industrial lighting fixtures and reflectors.

•

New Wire Factory Planned at Rhode Island Site

Sale of the former Pawtucket (R.I.) plant of Anaconda Wire & Cable to the newly formed Narragansett Wire Co. of that city has been consummated, according to deeds filed December 31. The new company's capital stock totals over $500,000, and revenue stamps indicated a sale price of approximately this amount. It is planned to manufacture wire, cable and other products. Anaconda has operated this plant, formerly the Tubular Woven Fabrics Co., since 1929. The new company is headed by W. R. Morley, formerly general manager of the Anaconda company in Pawtucket.

Natural Rubber Famine Continues into 1946

Measured against pre-war consumption and even greater post-war requirements, 1946 will continue to be a "famine year" as far as natural rubber is concerned.

President A. L. Viles of the Rubber Manufacturers Association based his appraisal on latest reports from the major rubber producing areas. To it he coupled a warning that most sections of the world market will suffer acute shortages of finished rubber products for many months to come—probably into 1947.

"The picture is much brighter in this country," he said, "both as to raw materials and the finished products. Thanks to the availability in good supply of high quality synthetic rubbers, American manufacturers will reduce substantially the backlog of consumer demand that accumulated during the war years.

"Trade circles expect an all-time, peace-time record consumption of approximately 900,000 tons of rubber in this country in 1946. In light of difficult production problems in the troubled Far East, natural rubber producers may be unable to meet more than a third of this demand. Best current estimates are that natural rubber receipts in this country will run between 250,000 and 350,000 tons.

"Relatively low-cost, petroleum-base synthetic rubber plants with a proven capacity of between 500 and 600 thousand tons of GRS are currently operating. To this can be added estimated output of

FORTY YEAR DIFFERENCE—C. C. Shutt and William Boden of Westinghouse are examining a newly acquired ¼-hp., 1904-model motor. The "old boy" was obtained from a customer who wrote into the company asking for replacement parts. At the left of the 1904 model is a 1945 model, general-purpose, ¼-hp. motor and, at the extreme left, is a ¼-hp., high-speed aircraft motor

Tested for four years . . . .

Back in 1941 our engineers had completed the design of a new street-lighting control which unfailingly insures adequate illumination regardless of changes and fluctuations in weather and the twilight hour.

Wartime obligations prevented production, but for four years the engineers' prototypes have been tested under actual street-lighting conditions . . . time-proven, it is now offered as our

SUNSWITCH
LIGHT CONTROL

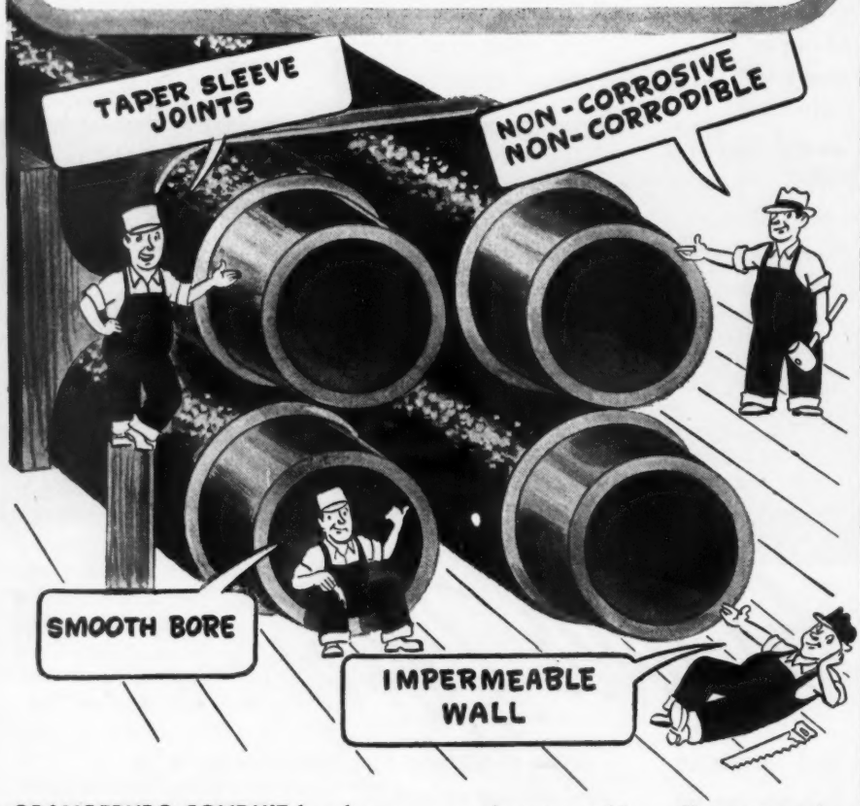
A practical and rugged unit with 100 percent safety factor . . . its sturdy components assure a negligble maintenance cost. Tooling up for large scale production is now completed. Write for Bulletin No. 8239.

The SUNSWITCH can also be used to control illumination of public buildings, outdoor advertising, airport beacons, radio mast running lights, and ships' running lights.

The **RIPLEY** *Company*

20 NEW LITCHFIELD STREET **TORRINGTON, CONNECTICUT**

You can depend on LONG, LOW-MAINTENANCE SERVICE with ORANGEBURG CONDUIT



ORANGEBURG CONDUIT has been used by the electrical industry for more than 50 years . . . *proving*, in practice, that it serves longer and better—with low first cost and less maintenance. ORANGEBURG* is strong, tough and light—easy to transport—easy to cut or work—simple to install.

Tight taper sleeve joints as well as impermeable walls prevent infiltration. Smooth bore protects against abrasion and strain when cable is pulled into duct—and as it expands and contracts under load. Safe against corrosion at the contact between sheath and duct.

The ORANGEBURG catalog is rich in worthwhile information. Write *today* for your copy!

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Graybar Electric Co., Inc. • *Distributors* • General Electric Supply Corp.

*Reg. U.S. Pat. Off.

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ORANGEBURG

WITH 50 YEARS EXPERIENCE IN THE MANUFACTURE OF NON-METALLIC CONDUIT AND PIPE, SERVES THE POWER AND LIGHT, TELEPHONE, GENERAL CONSTRUCTION, CHEMICAL, PETROLEUM, PLUMBING AND BUILDING SUPPLY FIELDS WITH ELECTRICAL FIBRE CONDUIT . . . ELECTRICAL UNDERFLOOR DUCT SYSTEMS . . . AND FIBRE PIPE FOR NON-PRESSURE USES.

70,000 tons of GRI, butyl, and 30,000 tons of GRM, neoprene.

"Indications are thus that basic raw materials requirements of American manufacturers will be met—even though these demands rocket nearly 50 percent above the 653,000 tons of rubber used in the last full peace-time year, 1940," Mr. Viles said.

"But with natural rubber continuing in tight supply throughout 1946, no wholesale conversions from synthetic rubbers are indicated. Receipts of even as much as 350,000 tons of natural rubber would actually be less than our manufacturers consumed in the critical war year of 1942.

"It must be noted, however, that the rubber manufacturing industry had converted successfully to use of 86 percent synthetic rubber by the war's end. That they were able to do this and still meet exacting military specifications on virtually all types of rubber products is a measure of the great progress in the field of synthetic rubbers since 1941," Mr. Viles asserted.

War requirements have diminished to the extent that the Civilian Production Administration estimates that expected natural rubber receipts may permit an average conversion of up to 70 percent synthetic rubber and 30 percent natural rubber some time in 1946.

•

A. B. Chance Purchases Bowie Switch Company

Announcement has been made by the A. B. Chance Co., Centralia, Mo., of the purchase of the Bowie Switch Co. of San Francisco, Calif. F. G. Chance, president of the A. B. Chance Co., stated that A. J. Bowie, seventy-one year old founder of the Bowie Switch Co., is being retained as consulting engineer. Mr. Chance also said that the company plans to expand the manufacturing facilities of the Bowie plant for the purpose of making some A. B. Chance Co. products for western consumption.

J. T. Isbell, who has been vice-president in charge of sales for the A. B. Chance Co. since 1939, and sales manager since 1931, has been made vice-president and Pacific Coast manager. J. A. Martin, who is at the present time superintendent of the Centralia plant, will be transferred to the Bowie plant as plant manager.

The switch company on the West Coast will be known as the A. B. Chance Company, Bowie Switch division.

•

Organizes Foreign Unit

Westinghouse Electric International Co. has started a new service department to help customers in South America and the Caribbean area with problems of

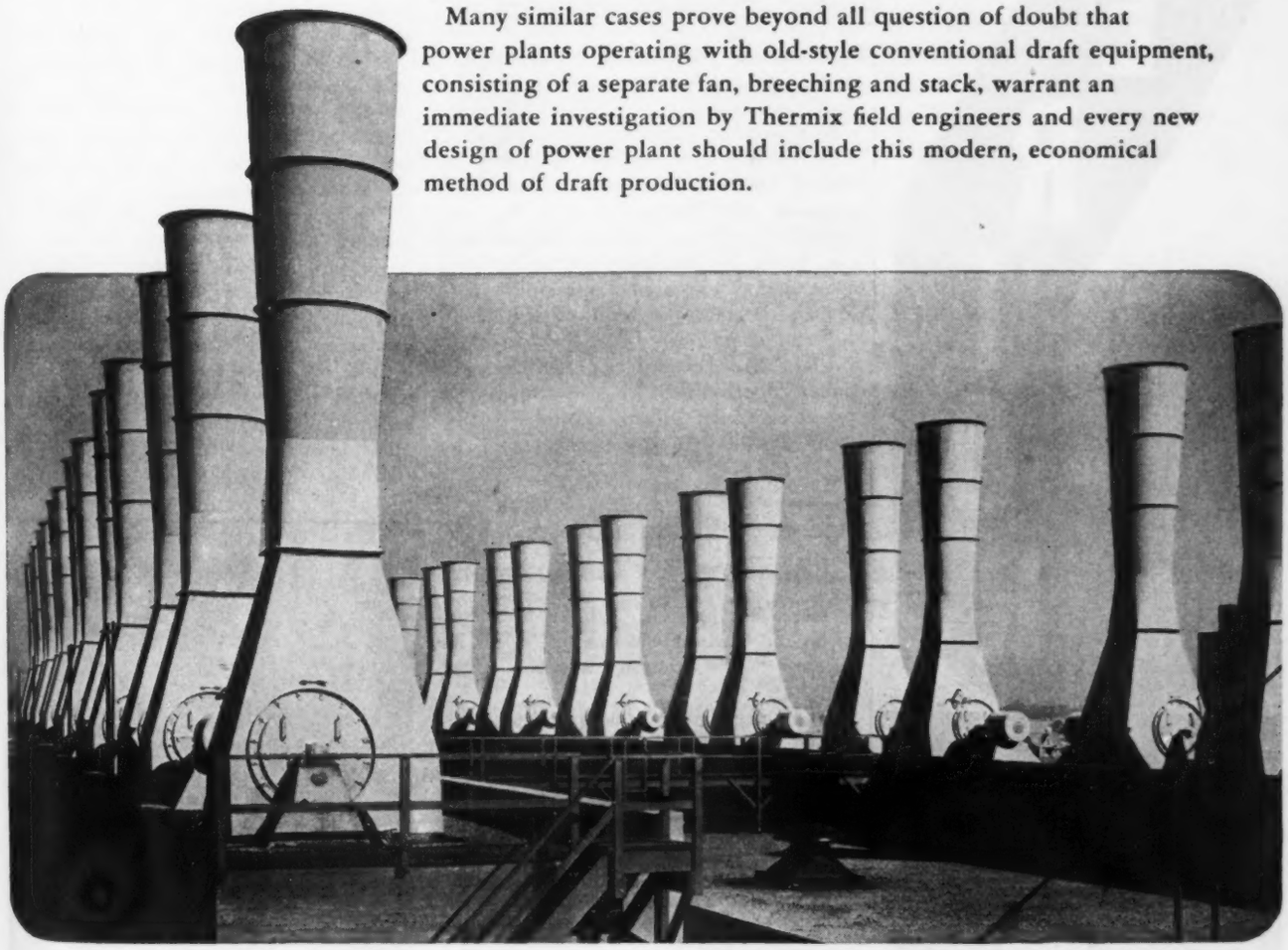
ELIMINATE *UNNECESSARY POWER PLANT DRAFT LOSSES*

LET THERMIX ENGINEERS PROVE HOW IT CAN BE DONE

Utmost power plant efficiency *demands* that fan, breeching and divergent stack be combined in a single compact unit in order to avoid resistances due to bends and sudden changes of section of duct work. This has been proved time and again by Thermix Fan Stack installations—in terms of hard cash savings in motor power consumption and in connection with almost any industry that might be mentioned.

Several years ago, for instance, the Schenley Distillers Corporation installed a single Thermix Stack by way of test. So great was the improvement that additional installations were quickly made!

Many similar cases prove beyond all question of doubt that power plants operating with old-style conventional draft equipment, consisting of a separate fan, breeching and stack, warrant an immediate investigation by Thermix field engineers and every new design of power plant should include this modern, economical method of draft production.



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Project and Sales Engineers

First National Bank Bldg., Greenwich, Conn.

PRAT-DANIEL CORPORATION

EAST PORT CHESTER, CONN.

SUPERIOR

... means *top quality* laboratory equipment, enclosures, test tables, switches, reactiformers and other electrical products built for industry by skilled workers in Superior's own plant.

SUPERIOR SWITCHBOARD & DEVICES CO.
CANTON 1, OHIO

equipment and operation of electrical machinery. J. F. Mann, formerly assistant manager of the industrial apparatus department, has been appointed manager of the new department.

•

Electrical Equipment Company Organized

Announcement is made of the formation of Perfect-Line Mfg. Corp. of Hicksville, N. Y., manufacturers of a wide range of electrical equipment and specialties. Scheduled for production at the Perfect-Line plant is a complete line of ventilating equipment for residential and industrial use, including the company's "Perfectaire" exhaust fans—built-in ceiling units available with or without incandescent lighting.

Other Perfect-Line products include wiring troughs and lamp holders for illuminating gasoline and service stations; receptacles for indoor and outdoor use; switch plates for oil burners; wire and cable dispensers for retail use.

At the helm of the new company is Alfred Robbins, its president and chief engineer. Mr. Robbins goes to the new organization from Burndy Engineering Co., where for the past ten years he was a member of the engineering staff. John M. Goettleman has been named plant superintendent.

Plans are being formulated for national distribution of the company's products, which will be marketed solely through wholesale electrical channels.

•

Alcoa Refining Patents Acquired by Government

The Aluminum Co. of America has given the Government free use of all its patents for extracting alumina from bauxite.

Announcement of the agreement between Alcoa and RFC was made at a recent press conference by I. W. Wilson, vice-president of Alcoa, and Surplus Property Administrator W. Stuart Symington.

Both officials emphasized that there is no connection between Alcoa's action and the Justice Department's anti-trust case pending against Alcoa.

•

Forms Argentina Unit

A new company has been organized at Buenos Aires to build a plant for the fabrication and distribution of Kelvinator products in Argentina, George W. Mason, Nash-Kelvinator Corp president, has announced. To be known as Darkel, the company is capitalized for two million pesos.

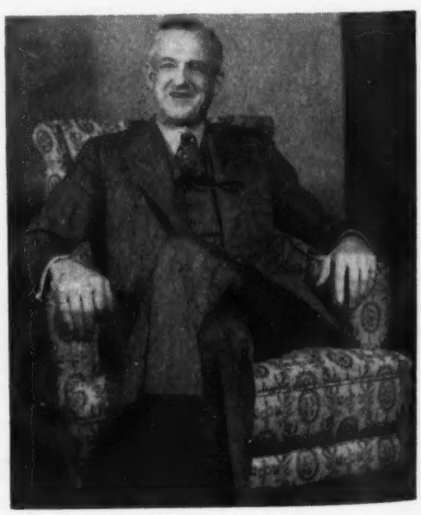
Appliance Production Reduced by Strikes

The home appliance industry is now prepared for production at levels higher than any other period, but the flow of goods from assembly lines has been held to a trickle by critical material shortages, according to George W. Mason, president of the Nash-Kelvinator Corp.

Mr. Mason declared that although the corporation built and shipped every unit it could assemble during the final quarter of 1945, supply problems held its refrigerator production to less than half of anticipated output. Other appliances, such as electric ranges, ice cream cabinets, beverage coolers, were affected even more seriously and in one case less than 4 percent of the schedule was met.

"Despite parts shortages resulting largely from labor difficulties in plants of outside suppliers," Mr. Mason said, "every effort was made to get our products into the hands of consumers." He revealed that about 25 percent of Kelvinator refrigerators were shipped to the field with parts, such as evaporator doors or ice trays, lacking.

The Kelvinator division had planned to produce about 90,000 new electric refrigerators in 1945, according to estimates set up immediately after the Japanese surrender, Mr. Mason continued. Actual production has been less than 50 percent of the projected total. With the momentum which it had hoped would be acquired in 1945, Kelvinator planned to build between 600,000 and 700,000 refrigerators in 1946 and by mid-year to be



SITTING PRETTY—A. B. Cooper, first president of the Canadian Electrical Manufacturers Association, relaxes in the easy chair presented to him by the members upon his retirement from office. Mr. Cooper is president and general manager of Ferranti Electric Ltd., Mount Dennis, Ont.

Gates — Intake, Sluiceway and Spillway
Hydraulic Turbines — Francis and Propeller Types
Rack Rakes • Trash Racks
Valves — Pipe Line and Penstock

★

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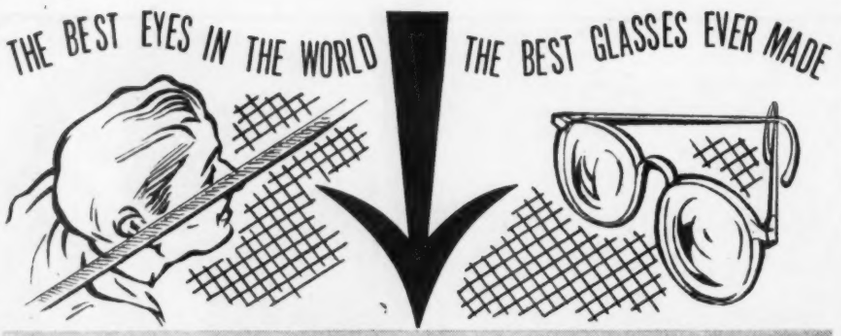
NEWPORT NEWS, VIRGINIA



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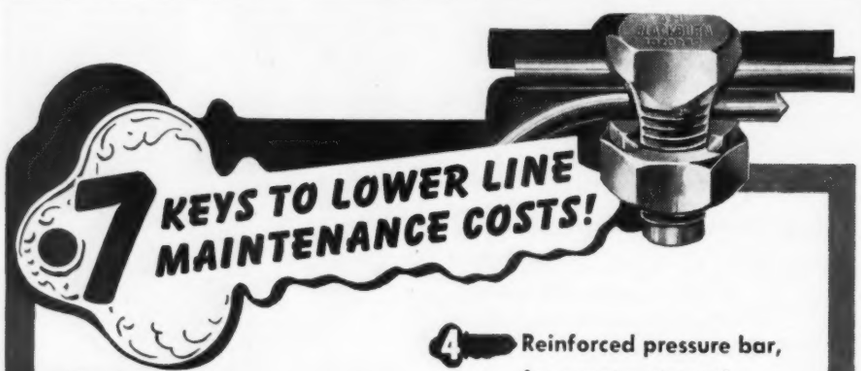

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1. Strongest connector made.
2. Can be used over and over again.
3. Conductivity of joint better than solid wire itself.
4. Reinforced pressure bar, for greater strength.
5. All corners rounded.
6. Machined to close tolerances.
7. Full threads on screw for maximum strength.

Over 100 Conveniently-Located Jobbers' Stocks

BLACKBURN Hi-Strength CONNECTORS

JASPER BLACKBURN PRODUCTS CORP., Main, Clinton and Madison Sts., St. Louis 6, Mo.

approaching its post-war goal of 1,100,000 home appliances annually. The division still aims at reaching that goal as early as possible, he said. The refrigeration industry as a whole, Mr. Mason said, had planned to build about 4,250,000 new refrigerators in 1946. Now, he believes, the industry total for the year is likely to be about 3,500,000.

"While it is naturally impossible in the light of present conditions to make accurate estimates of refrigerator production during the coming year, we know that the potentialities are great and that the new year offers an unexcelled opportunity for production, sales jobs and prosperity. With such possibilities facing us, we look forward optimistically, in spite of the fact that the nation's overall post-war program to date has been gravely retarded by materials shortages and labor problems in key industries."

•

Claude Neon Purchases Reeves-Ely Laboratories

Claude Neon Lights, Inc., New York, has acquired the Reeves-Ely Laboratories, Inc., of New York, according to an announcement by Morrell Mackenzie, Claude Neon vice-president.

Reeves-Ely Laboratories and its four subsidiaries, Waring Products Corp., American Transformer Co., Hudson American Corp. and Winsted Hardware Manufacturing Co., make a wide variety of products.

Through its apparatus department, Reeves-Ely Laboratories produces ordnance equipment, as well as equipment for the motion-picture and radio broadcasting industries. Waring Products manufactures the Waring "Blendor," an automatic food and beverage mixer and an automatic steam-electric iron; American Transformer manufactures power transformers and other electronic equipment, while Hudson-American Corp. of New York has developed a marine radiotelephone, various other marine communications devices and package transformers. Winsted Hardware manufactured electrical appliances and hardware specialties before the war.

Reeves-Ely Laboratories also announced that it has orders sufficient to insure capacity operations throughout 1946.

•

Aluminum Units to Reynolds

Reconstruction Finance Corporation has notified the Reynolds Metals Co. that it has approved the company's offer to lease the government-owned Hurricane Creek, Ark., alumina plant and the Jones Mill, Ark., aluminum reduction plant, R. S. Reynolds, company president, has announced.

640 PAGES of RELAY CIRCUIT DESIGN AND APPLICATION DATA

The Handbook That Answers Your Questions About Relay and Timer Construction, Selection and Use

Now available in a limited first edition, RELAY ENGINEERING, a new 640-page Handbook by Struthers-Dunn engineers brings you the full benefit of over a quarter of a century of specialized experience in designing, adapting and applying relays and timers to modern electric-electronic circuit requirements.

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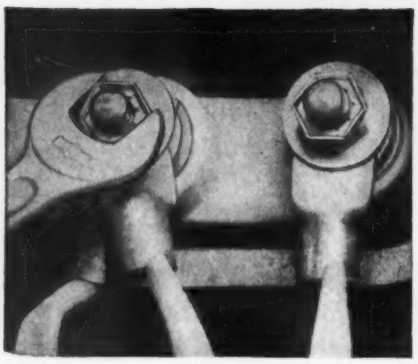
PALNUTS Keep Terminal connections Permanently Tight



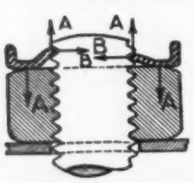
- **Perfect Conductivity**
- **No heating or corroding of contact surfaces**
- **Easy, speedy assembly**

Palnuts apply on TOP of the regular nuts, holding them to original tightness. Spring washers are eliminated between nut and terminal lug. There can be no backing off of nuts, nor opened spring washers to reduce contact. Instead, full conductivity of the entire nut seat is maintained under severest vibration.

Double-locking Palnuts are single thread locknuts, made of tempered spring steel or Duronze. They are easily, quickly spun on with the fingers and locked with 1/3 turn of a wrench. Require only 3 bolt threads space, are light in weight, low in cost, may be re-used.

Palnuts are available from stock for every utility requirement. Write for Palnut Manual giving engineering data.

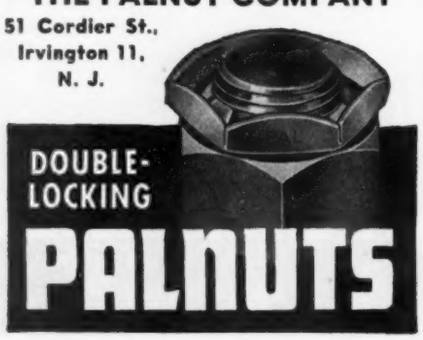
Double Locking Action



Arched, slotted jaws grip the bolt like a chuck (B-B), while spring tension is exerted upward on the bolt threads and downward on the regular nut (A-A), securely locking both.

THE PALNUT COMPANY

51 Cordier St.,
Irvington 11,
N. J.



Field Reports on Business

An unprecedented volume of industrial and trade activity is in sight, but unsettled labor conditions and shortages of essential materials are retarding progress. Electrical appliance orders are showing rapid increases, particularly in the small appliance field. Retail trade is running well ahead of last year.

CHICAGO

Electrical appliances are among the major items on the "back again" list in the mid-Winter mail order catalogues issued by the large firms in that field. Only the larger appliances are absent. Sears has announced that it will begin deliveries of home and farm freezers February 15 at prices "substantially below competitors' prices for the same items." Deliveries to stores will not begin until March 1. The winter home furnishings market being held in the Merchandise Mart has turned out numerous appliances that have not been seen for years, and some new items. Among those being shown are sewing machines, dishwashers, garbage disposal units, clocks and heaters.

That the retailing of electrical goods is overrated as a business field is the warning issued recently in a booklet by the Chicago Electric Association. It points out that supplies will be limited for some time and that first allotments will be given to seasoned dealers. Even new manufacturers will work through established dealers at first.

Commonwealth Edison Co. has developed a television program which demonstrates that such programs need not be expensive extravaganzas. It offers to televise its program from the store of any dealer in the Chicago area, and also offers to supply motion pictures on electric living or illustrated lectures on home planning, as sales promotion devices.

Standard Transformer Co., 1500 N. Halsted, Chicago, plans an 85,000 square-foot plant at Elston, Addison and Kedzie Avenues. The firm is one of the largest independent users of stamping laminations in the country.

PACIFIC COAST

Despite scattered and threatened strikes, and exceedingly spotty deliveries of staple items by eastern factories, largely owing to such strikes as at Bryant and Arrow plants, there is little pessimism, and much major construction is being regularly announced by public and private sources.

The State of California has allotted $10,000,000 to cover many small projects. Pacific Telephone & Telegraph Co. will build a $2,000,000 office in Oakland, and has a five-year program of $400,000,000 for construction and Bell equipment in California and Nevada.

Orders include a 175-kw. frequency changer and thermit work, costing $22,000 for U. S. Mint; potential transformers and lightning arresters, costing $20,000 for Modesto Irrigation District; and a group of 3,000 and 5,000 kva. unit substations to Pacific Gas & Electric Co.

Westinghouse presented low bid of $355,828 covering three 30,000-kva. transformers for delivery to Earp, Calif., for Parker Dam project, and low bids totaling $84,841 covering one 800-amp. circuit breaker and two 800-amp. disconnect switches for the same project.

U. S. Reclamation has planned $640,465,000 of projects for Arizona, the largest and longest to complete being the 1,110,000-kw. Colorado-Phoenix plant and system on Colorado, costing $333,000,000 and scheduled for ten-year completion.

REA has allotted $515,000 to cover 500 miles of line serving 600 members in Spokane, Whittier, and Garfield Counties in northeast Washington.

NEW ENGLAND

Maine paper and textile interests have plans prepared for modernization of plants which will involve the expenditure of $18,000,000. With 65 percent of Maine's rural areas now served, electrification of the entire state, according to Frank E. Southard, chairman of the state public utilities commission, can be completed at a cost of $15,000,000, with farm and home equipment calling for an additional $5,000,000. Already one utility has 40 miles of poles set, and another is accumulating 15,000 poles to cover about 430 miles of construction.

West Lynn Works (G.E.) will manufacture a.c. and d.c. instruments for Virginia Railway's 4 new electric locomotives, the most powerful continuously rated units in the country. General Electric plans expansion of its Pittsfield (Mass.) Works, and it is announced that the River Works, Lynn (Mass.) force will double the pre-war roll.

Connecticut Power Co. has installed, in cooperation with Southern New England Telephone Co., a communication system including a single circuit interconnecting twelve stations with regular hand telephone and loud speaker apparatus. Electrical appliance orders are showing rapid increases; a new shipment of electric vacuum cleaners was reported by one distributor last week, and war surplus electrical apparatus sales are at a good pace.

Manufacturers of electrical equipment are showing encouraging interest in an exposition to be held May 15-17 at Boston by the Electrical Manufacturers Representatives Club of New England. It is estimated that about 240 exhibits will be allotted space.

NEW YORK

Actual and threatened work stoppages due to industrial disputes continue to present the greatest obstacle to swift and orderly reconversion.

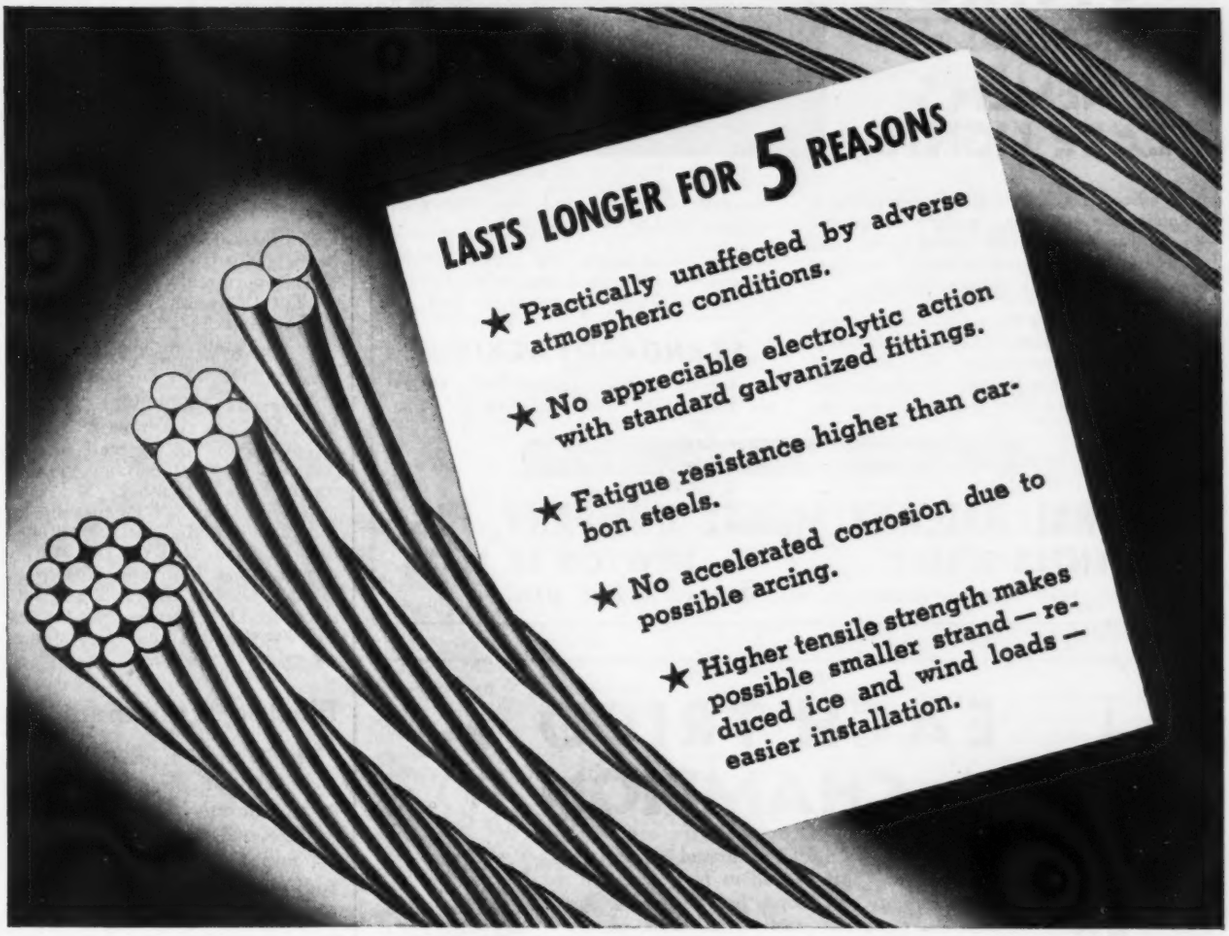
The Art Metal Co., Cleveland, has announced that all prices on residential lighting equipment in catalog 444 have been withdrawn, stating that unsettled economic conditions affecting the cost of materials, labor, and operations have already increased and are expected to further increase the total cost of the company's products. Delivery schedules, according to the statement, depend upon the company's ability to secure the necessary materials and parts needed in its products.

Civil engineering construction volume in continental United States totaled $87,971,000 for a seven-day week (due to preceding short weeks during holidays) ending January 1, 1946, as reported to *Engineering News-Record*. This volume was 103 percent greater than the volume reported for the preceding week (a three-day week) and was 284 percent greater than in the corresponding 1945 week (a five-day week).

Retail trade in the Metropolitan area forged ahead rather sharply last week. Gains for department stores were estimated as ranging to 25 percent over the preceding year.

PAGE *Stainless Steel* STRAND

for Ground Wire, Guy or Messenger Wire


LASTS LONGER FOR 5 REASONS
★ Practically unaffected by adverse atmospheric conditions.
★ No appreciable electrolytic action with standard galvanized fittings.
★ Fatigue resistance higher than carbon steels.
★ No accelerated corrosion due to possible arcing.
★ Higher tensile strength makes possible smaller strand — reduced ice and wind loads — easier installation.

Repair and replacement is postponed indefinitely where Page stainless steel strand is used for messenger wire —for ground wire—guys—catenary construction on electrified railways. Tensile strengths from 95,000 to 235,000 P.S.I. 3-wire, 7-wire and 19-wire strand available in $\frac{1}{4}$" to $\frac{1}{2}$" diameters. For complete information, write to the factory in Monessen, Pa.

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AMERICAN CHAIN & CABLE

TRADE MARK

For NIGHT REPAIRS and LINE PATROL
• CENTRAL •
LINEMEN'S FLARE LIGHTS

An efficient, economical form of portable illumination — giving daylight vision for night repairs and line patrol work. Unaffected by wind, rain or snow. Two sizes — 20 or 30 minute lighting periods.

Central Linemen's Flare Lights are invaluable during outages or other emergencies when quick, dependable illumination is imperative. Easily lighted in any weather by self-contained friction cap. No matches required. Stick in a post, tree, cross arm, in the ground or carry by hand.

They're always ready, and provide ample illumination. Standard equipment with prominent utilities throughout the land.

STANDARD PACKING

No. 3020-20 min., per case of 72....$12.00
No. 3030-30 min., per case of 36.... 9.00

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Each TRICO PRODUCT illustrated is " tops " in its field. Each is famous for its proven dependability and " know how " engineering that assures lowest maintenance costs, maximum protection against unnecessary shutdowns, lost man-hours, replacements and repairs.

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"PREFERRED FOR QUALITY"

TRICO FUSE MFG. CO.
MILWAUKEE 12, WISCONSIN

Manufacturers Make Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs:

Reliance Electric & Engineering Co., Cleveland, has named Harold J. Thompson district manager in Gary, Ind. Mr. Thompson will serve the industries of the Calumet and northern Indiana districts, with headquarters in the Gary National Bank Building.

Hoskins Manufacturing Co., Detroit, has appointed James W. Sterenberg Cleveland manager to succeed James D. Sterling, retired. Mr. Sterenberg was formerly in the company's Chicago office. D. E. Swan, formerly in the New York office, has been transferred to Chicago.

Standard Transformer Co., Warren, Ohio, has appointed Hunter and Bell representatives in northern New York State. Offices are at 259 Delaware Ave., Buffalo 2, and 625 Cumberland Ave., Syracuse 10, N. Y., with Fred L. Grant in charge of the Syracuse office.

Anderson Brass Works, Inc., Birmingham, Ala., has appointed J. E. Nelson representative covering the State of Indiana, with the exception of the Hammond District, and for the State of Kentucky. Mr. Nelson has offices located at 424 Peoples Bank Building, Indianapolis 4, Ind., and 209 Builders Building, Louisville 2, Ky. The Midwest Equipment Co. has been appointed representative for the states of Nebraska and Iowa, having offices at 1112 Farnum St., Omaha 8, Neb., and 908 Grand Avenue, Des Moines 9, Iowa.

•

Electric Equipment Show

The seventh annual Electrical Equipment Exposition, sponsored by the Electrical Maintenance Engineers of Milwaukee, will be held Thursday, January 31, and Friday, February 1 in the new auditorium of the Wisconsin Electric Power Co., located in the Public Service Building, 231 W. Michigan St., Milwaukee. More than 50 manufacturers of motors, motor controls, fuses, fixtures, lighting equipment, tools, and other electrical equipment, will exhibit.

•

Buys Allentown Plant

General Electric Co. has purchased from the RFC a 58,000 sq. ft. factory on South 12th St., Allentown, Pa., for the manufacture of electric appliances. According to present plans, 350 persons will be employed in the plant.

•

Locke Gets Navy Award

Locke Insulator Corp. has been awarded the U. S. Navy Certificate of Achievement "in recognition of exceptional acomplishment in behalf of the U. S. Navy and of meritorious contribution to the national war effort."

FARGO Vise-type Connectors and kindred products

(distributed by LINE MATERIAL CO., Milwaukee, Wis.)

"STANDARD" OR 5000 SERIES

Has all the outstanding advantages of the vise-like design, plus a removable bolt—a very convenient feature in making grounds, taps, etc., which can be removed and reassembled easily. For some jobs, the bolt can be removed, inserted through a hole in a lug, strap, bar, etc., and be quickly reassembled. Size range, No. 8 to 1,000,000 C.M.

HOT LINE CLAMP

Two sizes of clamps in this series. Cat. #HC-1 accommodates wire sizes #6 solid to, and including, #2 solid. Cat. #HC-2 accommodates #2 Str. to, and including, #4/0 Str. An unexposed thread packed with a non-corrosive lubricant insures easy turning at all times. An economical clamp for users who want strong, light jumpers. All-cast bronze, same as larger types. Weighs less than ½ standard types.

LINE SPLICES

4 jaws, with narrow surface, grip better than a wide surface; adjust better to wire contour. Screw-machined jaw insures consistent accuracy. In the 1-pce. assembly jaws keep automatically aligned. Natural spring of Everdur metal provides constant pressure when wire is inserted. 11 sizes cover range from No. 8 str. through 250 MCM. 3 sizes for No. 8-A, No. 6-A, No. 4-A Copperweld-Copper. Also, reducing splices for practically any wire size combination.

DEAD ENDS

Type CL-69—Design includes a standard Fargo Line Splice gripping unit attached to a yoke, permanently hinged on one side to Copperweld bail with push-out fastening on the opposite side. Can be installed easily without risk of loosening parts. Range same as line splices.

Type CL-37—Furnished with standard Fargo Line Splice gripping unit encased in bronze bushing which floats in ball-and-socket joint of galvanized steel clevis. Range same as line splices.

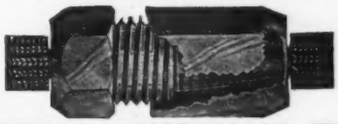
A.G.E.—1 Hot Line Clamp

Prevents arcing due to loose contact. Heavy coil spring works in conjunction with vise-type body construction to exert constant pressure which equalizes differential between the expansion and contraction of the clamp and the conductor, caused by temperature changes, vibration, or flowing of conductor metals. Spring made of vanadium steel, stress-relief annealed after plating, guarantees permanent spring strength. Completely housed and lubricated bolt thread assures easy turning. Any standard hot stick can be used for installation.

Fargo Spacer-Bar Connectors
(#7000 Series)

Prime feature is design of body which distributes applied pressure around the entire periphery of each individual conductor being clamped. In addition, a much larger longitudinal portion of the conductor is clamped upon because of the wider connector jaws. This is desirable in large multi-strand conductors because less "relaxation" occurs under high sustained temperatures. Same vibration-proof vise-type body construction as regular patented Fargo solderless connector.

CONE TYPE CONNECTORS



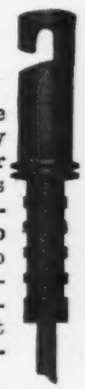
SERIES A SOLDERLESS—Wire-gripping cones are compressed about wires after the internally tapered body is tightened, producing high conductivity. In pull test, will develop full strength of wire for which it is intended. Made of high-copper, high-strength alloy to give years of service without distortion, fatigue, season cracking. Range, No. 14 sol. to 500 MCM. Reducing connectors available in practically all wire combinations.

SERIES *AT* SOLDERLESS—Due to action of pressure bar on run wire—which is an integral part of cone-gripping tap wire—this tap functions unusually well. Range, No. 14 sol. to 500 MCM.

SERIES *DU* "DU-ALL"

All features of Fargo Unit Connector, plus serving "T", end-to-end, or parallel connections by simply rotating gripping member. 6 str. to 500 MCM run or tap.

TEMPORARY JUMPER CLAMP
(Cat. #TJ-1)



Fast, convenient, positive means of making temporary jumper contacts. Quarter turn of handle releases spring-action connector; additional full turn is ample to tighten clamp. Insulated to withstand 5000 volts minimum with heavy rubber covering bonded to metal. Fast spring action minimizes arcing during installation.

LOCK NUT TYPE SPLICE

Has 3 outstanding advantages: each wire when inserted can be securely locked; backward travel of jaws is prevented; has longer serrated gripping jaws. In addition, has all features of the automatic splice. Wire sizes: No. 1/0 sol. to 250 MCM.

Hot Stick—A new clamp stick that holds securely all standard eye bolts found on jumper clamps, fuse cutouts, etc., regardless of angle that stick is held. Operated by hand lever on side of head, or by slight upward thrust of stick. Automatic lock device prevents accidental release. Knob on hand lever shows position of stick mechanism at all times. Selected ash sticks with high-strength aluminum alloy heads.

FLASH-WELD SIGNAL BOND

Fargo produces any type of bond for railroad signaling. Strongly flash-welded at junction of terminal and strand; terminals carefully galvanized. Flash-Weld Signal Bonds undergo most rigid inspection tests.

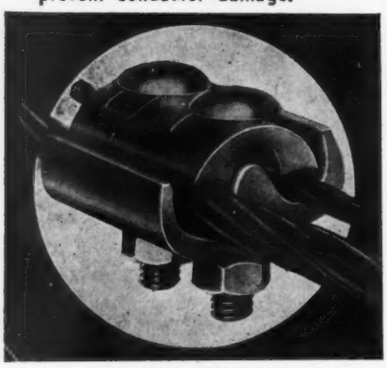
FARGO TWIST SLEEVES

Fargo Twist Sleeves are made of seamless high conductivity copper and are held to the specifications approved by N.E.L.A. They are of the proper temper, free from burrs, clearly stamped and conveniently packaged.

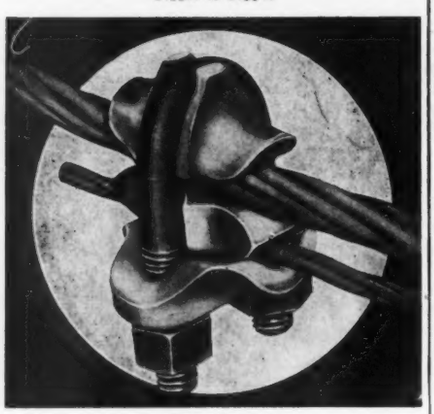
FARGO MFG. COMPANY ESTABLISHED 1914 POUGHKEEPSIE, NEW YORK

3 POINT CONTACT LINE CLAMPS
ANDERSON

OUTSTANDING performances through more than 18 years of service on the lines of leading utilities throughout the Nation is the record of Anderson's 3-point contact line clamps. Adapted to a wide range of cable sizes. Can carry overloads without overheating. Belled grooves prevent conductor damage.



Type LC-100
Copper to Copper



Type LC-71
Aluminum to Aluminum

We are ready to meet the expansion needs of utilities with a complete time-proved line of ground clamps; line clamps—aluminum and bronze; service taps; tap lugs; universal lugs; T-connectors; all types of bus fittings for substation, construction and maintenance. Representatives in all principal cities.

ANDERSON BRASS WORKS
INCORPORATED
BIRMINGHAM ALABAMA

Sales Opportunities

NORTH DAKOTA—Northern States Power Co., Minneapolis, Minn., plans early construction of new power plant at Minot, for auxiliary service. Site has been selected on Central Ave. Installation will include two 750-kw. diesel engine-generator units and auxiliary equipment. Cost estimated about $850,000. Company also will construct addition to operating headquarters at same place.

TEXAS—Sheffield Steel Corp. of Texas, Inc., Houston Ship Channel, Houston, plans expansion and improvements in plant, comprising additional buildings, with machinery and electrical equipment for increased capacity. Cost about $2,500,000. Work will begin at once and be carried out over period of several months. Company is a subsidiary of American Rolling Mill Co., Middletown, Ohio.

KANSAS—City Council, Coffeyville, will receive bids until January 29 for two complete steam-generating units for installation in municipal power plant, each consisting of boiler, superheater, air preheater, feed-water regulator, induced draft fan, forced draft fan, firing apparatus, combustion control equipment, instruments, etc. Black & Veatch, 4706 Broadway, Kansas City, Mo., are consulting engineers.

OREGON—Bonneville Power Administration, Portland, plans new 69,000 volt transmission line from power substation at Walla Walla, Wash., to Milton, about 5 miles, for light and power service at latter place.

LOUISIANA—Celotex Corp., 120 South La-Salle St., Chicago, Ill., plans expansion and improvements in plant at Marrero, near New Orleans, comprising number of additional buildings, with machinery and electrical equipment for large increased output. Capacity of power house will be increased. This is part of a general 1946 development program estimated to cost about $7,000,000. Proposed to begin work at early date.

COLORADO—Construction Service, Veterans' Administration, Washington, D. C., is asking bids until February 26 for new institutional buildings and utilities at Grand Junction, including boiler plant with boilers and auxiliary equipment, outside electrical distribution system, electric elevators, electric conduit system for interior service, and other electrical installation; also, air-conditioning system and pneumatic tube system, all as per plans and specifications on file.

PENNSYLVANIA—American Viscose Corp., Delaware Trust Bldg., Wilmington, Del., has authorized expansion and improvements in mill at Marcus Hook, including modernization of present facilities. Work will comprise additional buildings and installation of machinery and electrical equipment for considerable increased capacity. Program will be carried out over period of several months and will represent total investment of about $2,000,000. Company also will make extensions in branch mill at Meadville, for larger output in acetate department.

INDIANA—Board of Public Works, Goshen, plans expansion and improvement in municipal power plant, including addition to present building and installation of two new diesel engine-generator units, 1,500-2,000-hp. rating, with complete accessory equipment. Cost reported about $500,000. Burns & McDonnell Engineering Co., 107 West Linwood Blvd., Kansas City, Mo., is consulting engineer.

CALIFORNIA—Southern California Edison Co., Los Angeles, plans addition in maintenance department at plant at Alameda St. and Rosencrans Ave., Compton, about 100 by 100 ft. Work will begin soon.

COLORADO—Bureau of Reclamation, Denver, will receive bids until January 30 for three rotary-type pumps, with electric motors, controls, etc. (Invitation D-33,244-A-1).

IOWA—Town Council, Orange City, will receive bids until February 11 for extensions and improvements in municipal power plant, including (Section 1) Installation of diesel engine-generator unit, rating from 1,400 to 1,800 hp., complete with generator and accessories; (Section 2) Installation of heat recovery unit and electrical equipment in power plant, including switchboard, addition to bus structure, etc.; and (Section 3) Remodeling of engine room and other work in station interior.

OHIO—E. I. duPont deNemours & Co., Electrochemicals Department, duPont Bldg., Wilmington, Del., plans new plant for production of formaldehyde, used in plastics industry, on site near factory of Grasselli Chemicals Department, another division of company, Metzinger Rd., Toledo. It will comprise a main multi-story building and auxiliary structures, with machinery and electrical equipment for large capacity. Cost about $1,000,000. Proposed to begin work early next spring.

WASHINGTON—Bureau of Reclamation, Denver, Colo., will receive bids until February 18 for twelve 12 by 12-ft. bulkhead gates for installation at inlet end of outlet conduits at Grand Coulee dam, Columbia Basin project. Equipment will be installed by government (Specifications 1146).

CALIFORNIA—City Council, San Diego, plans extensions and improvements in street-lighting system in different parts of city, including certain replacements in present facilities. Cost reported close to $200,000. F. A. Rhodes, Civic Center Bldg., is city engineer.

NORTH DAKOTA—Otter Tail Power Co., Fergus Falls, Minn., will begin superstructure soon for proposed new steam-electric generating station at Devils Lake, with installation to include 5,000-kva. turbine-generator unit and accessories, high-pressure boilers, stoker-equipped to use lignite fuel, and auxiliary equipment. At later date, it is planned to double capacity of plant.

ILLINOIS—Municipal Light Department, Freeburg, plans remodeling and improving municipal steam-electric generating station, with installation of additional equipment. Estimates of costs are being made.

CALIFORNIA—Howard R. Fuller, city manager, Coronado, plans call for bids by close of month for installation of an ornamental lighting system on certain streets.

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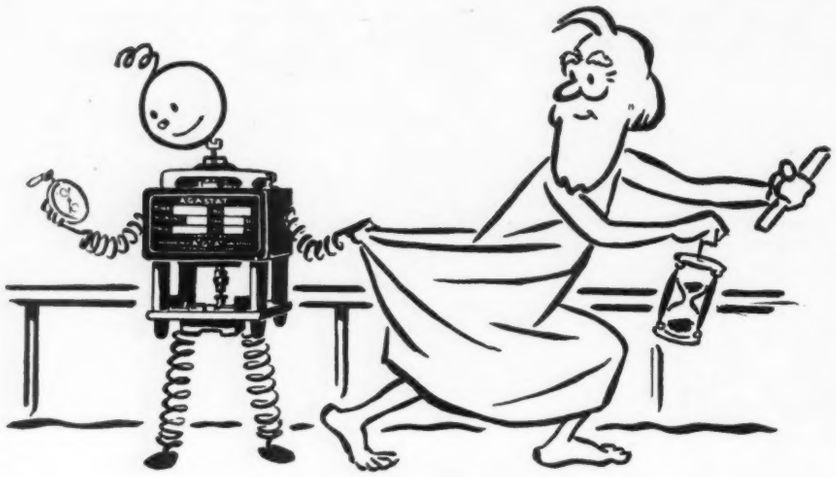

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Recent Rate Changes

CENTRAL NEW YORK POWER CORP. and NEW YORK POWER & LIGHT CORP. have filed revised rate schedules for residential service providing for reductions estimated at $706,000 annually as part of the $1,600,000 reduction agreed upon in negotiations recently between the two utilities and the commission (ELECTRICAL WORLD, December 8, 1945, Page 235). Customers of Central New York Power in territory extending from Onondaga County in Central New York to Jefferson County in the north will receive a reduction of approximately $343,000 and the Albany capital district and adjacent areas supplied by New York Power & Light Corp. will benefit to the extent of about $363,000 a year. The new residential rates became effective January 1. Schedules for the balance of the revisions applicable to commercial and industrial service are now in process of preparation, the commission stated. The commission's rate staff explained that the revised schedules attempt to bring about a greater uniformity in rates throughout the territory served by the two companies.

MANITOBA POWER COMMISSION has made a reduction in rates throughout its system, Herbert Cottingham, chairman, has announced. The new rate, which went into effect January 1, applies to all domestic and farm customers served by the commission.

VERA IRRIGATION DISTRICT (WASHINGTON) consumers have been given a reduction of 30 to 36 percent in electric power rates, Dan S. Whitman, president of the board of directors, has announced.

HOPKINSVILLE (KY.) ELECTRIC DEPARTMENT has put into effect a reduction in the electricity rates for commercial users, Mayor A. S. Koon, chairman of the Hopkinsville Utility Commission, has announced. The reduction, according to the Mayor, will mean a saving of approximately $10,000 a year on light and power bills.

BOSTON EDISON CO. rates will be reduced on March 1 to give residential and commercial customers a total saving of approximately $1,200,000 per year, following conferences between the company and the Massachusetts Department of Public Utilities. About half this saving will be to domestic users. Detailed schedules will be filed with the board by February 15. In an estimate of its business prospects for 1946 the company informed the department that even with the repeal of federal excess profits taxes in 1946, the company will still be subject to federal income taxes at a rate of 38 percent, as compared with 24 percent in 1940 and 19 percent in 1930. Savings in federal taxes will be offset, however, by increased costs of labor, fuel, supplies and materials. Fuel costs per ton are now 40 percent higher than in 1940 and there may be further increases during 1946. Up to the present, the company has not attempted to collect any of this excess cost of fuel from residential and small commercial customers, even though there are fuel clauses in the rates applying to such customers.

Arkansas Lines Authorized

Arkansas Public Service Commission has authorized the Petit Jean Electric Cooperative to construct 211 miles of lines and the Arkansas Power & Light Co. 313 miles. The co-op was also authorized to buy 22 miles of lines from the utility.

OUR BIG JOB FOR THE BELL SYSTEM

From far off places must come many materials needed to make your telephone—including flax, mica, asphalt, tungsten, antimony, cobalt, tin, platinum.

Farms of this country must supply essential products and by-products—such as cotton, wool and leather.

IMPORTING FARMING

Then the mines must yield copper, iron, lead, aluminum, chromium, zinc, nickel, coal, gold, silver—all required in telephone apparatus.

Twenty-five domestic varieties of wood enter into the nation's telephone service. Their uses range from switchboards to poles and booths.

MINING FORESTRY

Raw materials must be brought together in Western Electric plants, where skilled workers and marvelous machines turn them into vast quantities of complex apparatus.

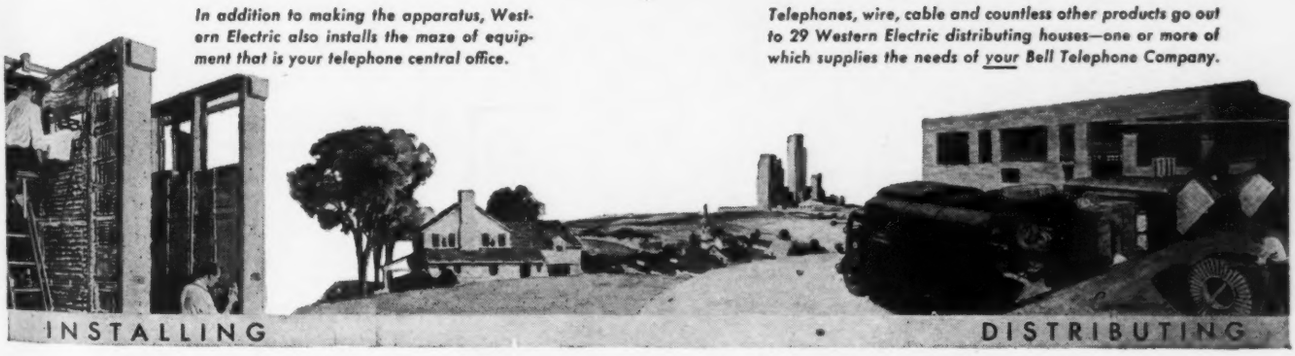
Wiring an intricate switchboard—through which your voice will go—calls for skilled hands. Remember that switchboards and cable are just two of thousands of items you use when you telephone.

Making telephone cables no larger than a man's wrist—yet containing thousands of wires—is the job this giant stranger does.

MANUFACTURING

In addition to making the apparatus, Western Electric also installs the maze of equipment that is your telephone central office.

Telephones, wire, cable and countless other products go out to 29 Western Electric distributing houses—one or more of which supplies the needs of your Bell Telephone Company.



INSTALLING DISTRIBUTING

As supply unit of the Bell Telephone System, Western Electric has one of industry's most complex jobs.

Today we are working full speed ahead on equipment not only to meet immediate telephone needs, but also to carry out the Bell System's $2,000,000,000 post-war construction program.

This vast program promises a record in peacetime production at Western Electric—with a level of employment higher than in the years just before the war—and better-than-ever telephone service for you.

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The "Impossible"
will serve you
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Peacetime.

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THE HARTFORD ELECTRIC LIGHT CO.

REA Allots Funds; Approves Contracts

The Rural Electrification Administration recently announced approval of loan allotments totaling $8,276,200 to 47 rural co-ops in 26 states. Unless otherwise noted, the allotments which are listed below will be used for line construction to extend electric service in the areas of the systems involved.

ALABAMA—Marshall-DeKalb Electric Co-op., Boaz, $385,000; Wiregrass Electric Co-op., Inc., Hartford, $50,000.

ARIZONA—Ma-Yu Electric Co-op., Inc., Buckeye, $305,000; Littlefield Electric Co-op., Inc., Littlefield, $2,000.

ARKANSAS—C. & L. Rural Electric Co-op. Corp., Star City, $400,000; Woodruff Electric Co-op. Corp., Augusta, $255,000.

GEORGIA—Washington County Electric Membership Corp., Sandersville, $50,000; Little Ocmulgee Electric Membership Corp., Alamo, $30,000 for wiring, plumbing and appliance loans to members.

INDIANA—Southeastern Indiana Rural Electric Membership Corp., Osgood, $635,000; Consumers Electric Refrigerator Membership Corp., Orleans, $40,000 for construction of refrigerated locker plant.

IOWA—Glidden Rural Electric Co-op., Glidden, $73,000, which with funds from previous allotments will finance installation of two generating units.

KANSAS—Kaw Valley Electric Co-op. Co., Inc., Topeka, $290,000; Doniphan Electric Co-op Assn., Inc., Troy, $191,700; Cooperative Power & Light Co., Inc., Iola, $125,000; Ninnescah Rural Electric Co-op. Assn., Pratt, $15,000.

KENTUCKY—Shelby Rural Electric Co-op. Corp., Shelbyville, $430,000, which includes funds for substation installation; South Kentucky Rural Electric Co-op. Corp., Somerset, $313,000.

LOUISIANA—Claiborne Electric Refrigeration Co-op., Inc., Homer, $3,500 to complete refrigerated locker plant.

MARYLAND—Southern Maryland Electric Co-op., Inc., Waldorf, $66,000.

MICHIGAN—Oceana Electric Co-op., Hart $140,000.

MINNESOTA—P.I.C.K. Co-op. Electric Assn., Braham, $112,000; Itasca-Mantrap Co-op. Electric Assn., Park Rapids, $105,000; Border Counties Power Co-op., Inc., Warroad, $70,000, which with funds from previous allotments will finance installation of two generating units.

MISSISSIPPI—Central Electric Power Assn., Carthage, $50,000.

MISSOURI—Farmers' Electric Co-op., Chillicothe, $150,000; Ralls County Electric Co-op. Assn., New London, $65,000; Lewis County Rural Electric Co-op. Assn., Monticello, $55,000.

MONTANA—Park Electric Co-op., Inc., Livingston, $67,000; Mid-Yellowstone Electric Co-op., Inc., Hysham, $55,000.

NEW MEXICO—Sierra Electric Co-op., Inc., Hillsboro, $50,000.

NORTH CAROLINA—Burke-McDowell Electric Membership Corp., Morgantown, $236,000; Cornelius Electric Membership Corp., Cornelius, $89,000.

NORTH DAKOTA—Minnkota Power Co-op., Inc., Grand Forks, $1,500,000 for construction of transmission lines and installation of three generating units.

OKLAHOMA—Cotton Electric Co-op., Walters, $45,000; Harmon Electric Assn., Inc., Hollis, $35,000; Kay Electric Co-op., Blackwell, $35,000.

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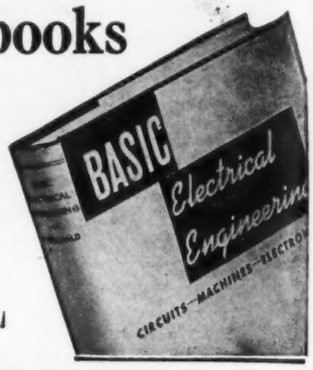

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Direct and fundamental treatment of electrical engineering, presenting an integrated view of circuit theory, electrical-machinery fundamentals and applications, and engineering electronics. Gives the reader a rapid grasp of working fundamentals from simplest circuit concepts to instrumentation and automatic-control applications in research and industry.

2. ELECTRONICS DICTIONARY

By NELSON M. COOKE, Lt. Com., U. S. N., Executive Officer, Radio Materiel School, Naval Research Laboratory, Washington, D. C., and JOHN MARKUS, Associate Editor, *Electronics*. 433 pages, 5¾ x 8¾, over 600 illustrations, $5.00.

An authoritative dictionary containing accurate definitions for nearly 6500 terms used in radio, television, industrial electronics, facsimile, sound recording, etc. More than 600 appropriate diagrams and sketches illustrate the principles and equipment described. Of value to editors, engineering secretaries, engineers, and students for its complete and consistent policy on abbreviations and compound terms.

3. APPLIED MATHEMATICS

For Radio and Communication Engineers

By CARL E. SMITH, Assistant Chief, Operational Research Branch, Office of the Chief Signal Officer, War Department; Development and Research Engineer (on leave), United Broadcasting Company, Cleveland; President (on leave), Smith Practical Radio Institute, Cleveland. 336 pages, 5¼ x 8¼, 97 figures, 20 tables and charts, $3.50.

Clear, simple presentation of the principles of mathematics used in radio and communication engineering, from arithmetic through calculus which may be used for home study. Theory is developed inductively from the simple to the detailed concepts, then followed by design equations and practice examples. Includes a simple treatment of calculus, and a chapter on Series and Wave Forms.

4. CONTROLLERS FOR ELECTRIC MOTORS

By HENRY DUVALL JAMES, Consulting Engineer, and LEWIS EDWIN MARKLE, Design Engineer. 324 pages, 6½ x 9¾, 276 figures, 6 tables, $3.50.

A manual on all types of commercial motor controls, describing their construction, performance, and operation, and giving pointers on maintenance, for operating men, application engineers, and purchasers of controls. Gives a wealth of practical information on the safe and efficient control of motors, including helpful explanations and diagrams on electronic tube control, arc rupturing, operation of Amplidyne, etc.

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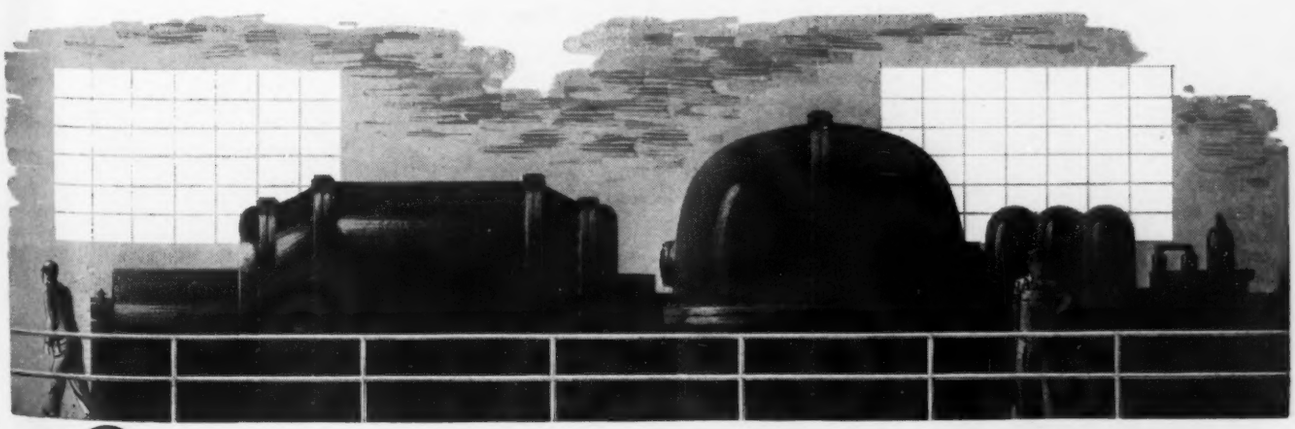

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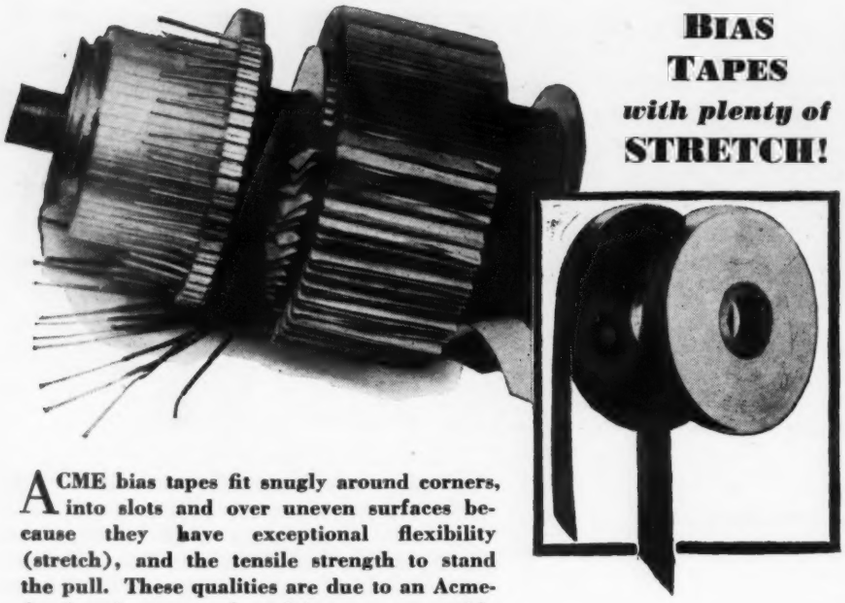

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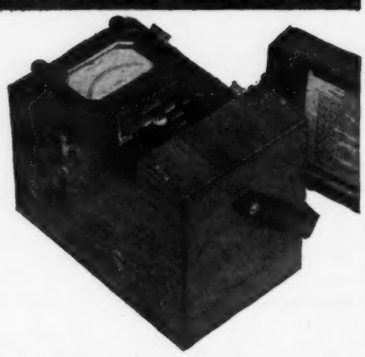
CINCINNATI, OHIO

***New*... CRANKLESS MODEL C-2 MEGOHMER INSULATION TESTER**



Test Potential to 600 Volts DC. Ranges to 1000 megohms with two or three additional ohm ranges in each instrument. Long mirror scales, hand drawn, individually calibrated, with more scale divisions for superior readability and split hair accuracy. Automatically decreasing test potential protects equipment of low resistance value.

Truly a Precision Instrument
WRITE FOR BULLETIN 445

HERMAN H. *Sticht* COMPANY, INC.
27 PARK PLACE NEW YORK, N. Y.

OREGON—Central Electric Co-op., Inc., Redmond, $75,000.

PENNSYLVANIA—Warren Electric Co-op., Inc., Youngsville, $248,000.

SOUTH CAROLINA—Edisto Electric Co-op., Inc., Bamberg, $220,000; Coastal Electric Co-op., Inc., Walterboro, $78,000 which includes funds for system improvements and substation installation.

TENNESSEE—Town of Bolivar, Bolivar, $160,000.

TEXAS—Wise Electric Co-op., Inc., Decatur, $142,000; Floyd County Rural Electric Co-op., Inc., Floydada, $115,000; New Era Electric Co-op., Inc., Athens, $115,000; Midwest Electric Co-op., Inc., Roby, $40,000.

VIRGINIA—Virginia Electric Co-op., Bowling Green, $50,000.

WASHINGTON—Inland Empire Rural Electric, Inc., Spokane, $515,000.

Construction Contracts Approved

ILLINOIS—Wayne-White Counties Electric Co-op., Fairfield, contract to E. A. Koeneman Electric Co., St. Louis, Mo., 263.6 miles of line; labor and materials, $283,192; engineer, Rural Line Engineers, Clayton, Mo.

INDIANA—Warren County Rural Electrification Membership Corp., Williamsport, contract to Contracting & Material Co., Evanston, Ill., 155 miles of line; labor and materials, $148,237; engineer, Philip L. Burns, Indianapolis, Ind.

MINNESOTA—Central Minnesota Co-op. Power Assn. of Redwood County, contract to W. A. Patterson, St. Paul, Minn., 18 miles of new line construction and 5 miles of conversion; labor and materials, $30,734; engineer, A. J. Christopherson, Fergus Falls, Minn.

MONTANA—Valley County Electric Co-op., Inc., Glasgow, contract to D. M. Manning, Hysham, Mont., 178 miles of line; labor and materials, $196,082; engineer, Montana State Water Conservation Board, Helena, Mont. Not all of this construction will be undertaken at this time.

NEBRASKA—Madison County Rural Public Power District, Battle Creek, contract to Douglas Contractors, Ltd., Omaha, Neb. 172 miles of line; labor and materials, $149,230; engineer, Harry Nixon, Omaha, Neb. Northeast Nebraska Rural Public Power District, Emerson, contract to Jensen & Krage, Sioux City, Iowa, 100 miles of line; labor and materials, $99,709; engineer, H. H. Henningson, Omaha, Neb.

TEXAS—Kaufman County Electric Co-op., Inc., Kaufman, contract to B & C Construction Co., Dallas, Texas, 119.3 miles of line; labor and materials, $94,899; engineer, Freese & Nichols, Fort Worth, Texas. Houston County Electric Co-op., Inc., Crockett, contract to Day P. McNeel Co., San Antonio, Texas, 107 miles of line; labor and materials, $84,533; engineer, Southwest Engineers, Houston, Texas. Cherokee County Electric Co-op. Assn., Rusk, contract to Jacques Power Saw, Denison, Texas, 90.1 miles of line; labor and materials, $79,769; engineer, H. B. Gieb & Associates, Dallas, Texas.

VIRGINIA—Southside Electric Co-op., Crewe, contract to McKinley Construction Co., Arlington, Va., 500 miles of line; labor only, $186,265. Prince George Electric Co-op., Disputanta, contract to Barnes & Weakes, Jarrat, Va., right-away clearing of 17 miles of line, $1,040; contract to Dorsett Electric Co., Arlington, Va., 79.2 miles of line; labor and materials, $69,923; engineer, McWhorter & Hylton, Staunton, Va.

WASHINGTON—Inland Empire Rural Electric Inc., Spokane, contract to Hughes Electric Co., Spokane, Wash., 30.4 miles of line; labor only, $13,858; engineer, H. A. Sewell, Newport, Wash.